

SUSTAINABLE CLEVELAND MUNICIPAL ACTION PLAN

October 2013



CITY OF CLEVELAND
Mayor Frank G. Jackson



TABLE OF CONTENTS

MAYOR’S MESSAGE	3
ACKNOWLEDGEMENTS.....	4
INTRODUCTION AND BACKGROUND	6
MUNICIPAL GREENHOUSE GAS INVENTORY AND FORECAST	9
SC-MAP	13
SC-MAP FOCUS AREA 1: DESIGN, CONSTRUCTION, AND MAINTENANCE	20
SC-MAP FOCUS AREA 2: ENERGY	26
SC-MAP FOCUS AREA 3: TRANSPORTATION	43
SC-MAP FOCUS AREA 4: WATER	52
SC-MAP FOCUS AREA 5: MATERIALS MANAGEMENT AND PURCHASING	63
IMPLEMENTING THE SC-MAP	70

LIST OF TABLES AND FIGURES

Table 1: Inventory Sources.....	10
Figure 1 : Annual GHG Emissions by Source	11
Figure 2: Annual GHG Emissions by City Department	11
Figure 3: Annual Costs by Utilities	12
Table 2: Utility Cost Escalation.....	13
Table 3: Cost Benefit Analysis	15
Figure 4 : Annual Cash Flow, through 2030	18
Figure 5: GHG Emissions Reductions	19
Figure 6: Annual Energy Use by City Department.....	27
Figure 7: Annual Fleet Fuel Use by City Department.....	43
Figure 8: Commuting Modes by City Employees	45
Figure 9: Annual Metered Water Use by City Department	53
Figure 10: City of Cleveland Waste Streams	64

LIST OF APPENDICES

Appendix A: GHG Inventory Methodology

Appendix B: Glossary of Terms/Acronyms

MAYOR'S MESSAGE



Local governments have the opportunity to play a leading role in promoting energy and resource efficiency, addressing climate change, and adopting more sustainable practices. In 2006, I signed the U.S. Mayor's Climate Protection Agreement. This signature acknowledges that the City of Cleveland takes climate change seriously and will make efforts to reduce the City's overall carbon footprint. The increase in greenhouse gas emissions over the last 150 years is having social, economic, human health, ecological, and security impacts on cities across the country.

Although Cleveland is well positioned for a changing climate because of our access to fresh water and our temperate climate, I have a steadfast commitment to reducing the carbon footprint of our operations. Some benefits of addressing sustainability and climate change include:

- Reduced energy and operational costs for government, residents, and businesses
- Stimulating local economic development through "green" job growth
- Reduced dependence on foreign fuel sources and vulnerability to energy price increases
- Diversified energy supply and reduced loads on the transmission system
- Protecting public health through reduced air pollution emissions, including ozone precursors and fine particulates
- Improved quality of life through reduced commuting times and greater overall mobility
- Improved educational opportunities
- Opportunities for regional, state, and national leadership and recognition

This Sustainable Cleveland Municipal Operations Plan lays out the pathway toward significant reductions in energy consumption and greenhouse gas emissions caused by municipal operations. This implementation plan is a major step in an informed and coordinated effort to ensure a healthy, economically resilient, and secure community that is the vision of the Sustainable Cleveland 2019 initiative.

This plan is part of a larger Climate Action Plan being led by the City of Cleveland. The Climate Action Plan aims to not only reduce GHG emissions, but also plan for changes in the climate that will affect Clevelanders. I look forward to engaging all City employees in this work as well as a diverse group of stakeholders in taking action on climate change. Only by working in coordination and collaboration can we transform Cleveland into a green city on a blue lake.

Sincerely,

Mayor Frank G. Jackson

ACKNOWLEDGEMENTS

The Mayor's Office of Sustainability would like to thank City staff and Green Team members from the following Departments who participated in the planning process.

Building and Housing
City Planning Commission
Community Development
Economic Development
Finance
Mayor's Office of Capital Projects

Port Control
Public Health
Public Safety
Public Utilities
Public Works



Special thanks to the following individuals who provided data or comments on drafts of this report:

Jil Calamante, Port Control
Charlett Chatman, Public Works, Division of Waste Collection and Disposal
Freddy Collier, City Planning
Jim Hardy, Finance, Purchasing
Lisa Hart, Finance, Printing and Reproduction
Ivan Henderson, Public Utilities, Cleveland Public Power
Jose Hernandez, Public Utilities, Division of Water
Columbus Kelley, Public Works, Motor Vehicle Maintenance
Scott Loomis, Finance, Printing and Reproduction
Alex Margevicius, Public Utilities, Division of Water
Robert Masseria, Human Resources
Simon Mastroianni, Public Utilities, Division of Water
Darwin McClellan, Public Works, Motor Vehicle Maintenance
Kim McGreal, Port Control
Tom Nagel, Public Works, Property Management
Carmen Nunez, Public Utilities, Cleveland Public Power
Ryan Olinek, Public Utilities, Division of Water
Ron Owens, Public Works, Division of Waste Collection and Disposal
Barbara Phillips, Public Utilities, Cleveland Public Power
Richard Pinkham, Port Control
Andre Reynolds, Finance
Ken Silliman, Chief of Staff
Richard Silva, Public Works, Park Maintenance and Properties
Meenakshi Singh, Port Control
Bob Vilkas, Mayor's Office of Capital Projects
Gwendolyn Waters, Public Utilities

The City of Cleveland would also like to thank the following organizations for their expertise in helping prepare this report:



U.S. Department of Energy



“This material is based upon work supported by the Department of Energy and the City of Cleveland under Award Number DE-EE0000705. This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately

owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.”

INTRODUCTION AND BACKGROUND

What is the Sustainable Cleveland Municipal Action Plan?



The Sustainable Cleveland Municipal Action Plan (SC-MAP) is a concrete sustainability action plan for Cleveland's municipal operations. Cities across the country, including the City of Cleveland, have embraced sustainability as a tool to enhance the viability of their organizations and

communities, benefit from increased efficiencies and reduced operating costs, enhance social services, drive innovation, and preserve valuable environmental resources. The SC-MAP establishes an organizational philosophy toward sustainability through proven policy, goals, actions, and performance metrics. While it is primarily intended to lay out specific actions for City staff, the SC-MAP also provides context for the public to understand the City's approach to sustainability in its operations and witness the results.

Sustainability planning can improve practices in municipal operations associated with energy use, transportation, solid waste, water consumption, purchasing, land use, employee engagement, and other areas. As a result, implementing the SC-MAP can serve to:

- Lower City energy costs for heating, cooling, and lighting;
- Reduce fleet motor vehicle fuel costs and emissions;
- Reduce waste generation and increase landfill diversion rates, thereby reducing landfill tipping fees and transportation emissions;
- Lower water costs and consumption;
- Improve water quality in Lake Erie and rivers that feed it;
- Increase employee satisfaction, productivity, and health, while lowering utility bills from constructing high-performing buildings and retrofitting existing buildings;
- Unite the City's many sustainability initiatives under one cohesive plan of action to create efficiencies and synergies;
- Engage municipal employees in the City's sustainability efforts; and
- Lead by example for the community and other municipalities.

SUSTAINABLE CLEVELAND 2019

Together, we're building a thriving Green City on a Blue Lake

Sustainable Cleveland 2019 is a 10-year initiative that engages everyone to work together to design and develop a thriving and resilient Cleveland region that leverages its wealth of assets to build economic, social and environmental well-being for all.

It supports and aligns efforts that are already being championed with intelligence and passion throughout the region and it activates new efforts and new leadership along the way.

SustainableCleveland.org



While the City is already practicing sustainability in several areas, the SC-MAP will accelerate progress in a more coordinated manner and help the City achieve even more significant outcomes. A first step in this process was development of the City Green Team in May 2012, consisting of representatives from across City government serving to integrate sustainability into City operations. A summary of the City's existing policies, programs, and example projects that embrace sustainability can be found at: www.city.cleveland.oh.us/Sustainability.

Framework of the Municipal Action Plan

The SC-MAP describes existing practices, goals, actions, and ways to measure progress toward sustainability in municipal operations, as well as the partners and resources needed for implementation. The priorities highlighted in the goals and actions represent some of the most significant opportunities the City has to make progress toward sustainability in its operations.

Informed by dialogue with City staff and drawing on best practices from other municipal sustainability plans, the SC-MAP's framework consists of Focus Areas, Goals, Actions, and Metrics. Each of these components is described below.

Focus Areas: Focus Areas are used to organize the SC-MAP's goals into themes in a consistent manner across various planning efforts. Specifically, these Focus Areas include:

- Design, Construction, and Maintenance;
- Energy;
- Transportation;
- Water; and
- Materials Management and Purchasing.

Goals: The Goals embody the desired outcomes that the City intends to achieve for each Focus Area. Where applicable, Goals include numeric targets and time frames for achieving these targets. In other instances, goals are more qualitative but still articulate a desired future end state.

Actions: Actions consist of specific steps that will be taken to meet the Goals. It is at this level where potential costs and benefits, both in financial and resource efficiency terms, are quantified to help scale and prioritize possible actions. For any given Goal there are generally several supporting Actions.

For each action, the plan includes an action description, performance indicators for monitoring progress, lead department, related actions, and first steps for implementation. In addition, the plan outlines strategies for training, funding and communicating progress. The Mayor's Office of Sustainability is available to support on implementation of each action. While not explicitly included under each action, departments not serving as lead will play a supporting role.

Performance Indicators: Performance indicators are numeric criteria used to validate, assess, and measure progress toward the stated desired outcomes at the Focus Area level.

Extending to the Community

Through the SC-MAP, the City recognizes the need to lead by example in promoting sustainability, but creating a truly sustainable economy in Cleveland requires the entire community. This is why the City of Cleveland led a process to create a community-wide Climate Action Plan (CAP) to not only reduce greenhouse gas (GHG) emissions and energy use, but also make Cleveland more resilient by preparing for existing and predicted changes in the climate. The CAP is distinct from the SC-MAP in that it focuses on issues and activities in the community beyond the City's own municipal operations and footprint. The City is engaging experts and community leaders from across Northeast Ohio, and the public as a whole, to create this path forward. For more info, visit www.SustainableCleveland.org.

MUNICIPAL GREENHOUSE GAS INVENTORY AND FORECAST



This section provides a baseline environmental inventory for the City of Cleveland's municipal operations. The inventory focuses on greenhouse gas (GHG) emissions – a helpful cross-cutting metric to evaluate the impact of various City activities. The inventory establishes a baseline from which to measure the City's progress toward sustainability from year to year. 2010 was selected as the baseline year based on data availability. Appendix A provides additional guidance on the methodology used for data collection and analysis.

Greenhouse Gases

There are six primary GHGs: carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), perfluorocarbons (PFCs), hydrofluorocarbons (HFCs) and sulfur hexafluoride (SF₆). Most of Cleveland's GHG emissions are the result of emissions of the first three gases; as a result, these are the only three GHGs considered as part of this inventory. PFCs and HFCs are primarily released as the result of normal operation and maintenance of refrigeration, air conditioning and fire suppression systems and are a minimal contributor to the City's inventory. SF₆ is found primarily in large electrical equipment, such as transformers, and was determined to be a minimal source of emissions for the City based on a review of data provided by the City.

Scopes, Sources, and Boundaries

The boundary for Cleveland's baseline inventory has been determined based on the concept of control and influence. All assets that the City owns and many services that it provides are included. Also included are other activities over which the City has a relatively significant level of operational control and for which data are available. **Table 1** outlines the inventory sources within this boundary that have been included in the City's municipal operations inventory, with the emission scope for each source specified.

With regard to GHG emissions, all activities are categorized into three scopes. **Scope 1** emissions are direct emissions occurring within the City's designated boundary (i.e. facilities under the City's operational control, both inside and outside of Cleveland City proper), **Scope 2** emissions are those

GLOBAL WARMING POTENTIAL AND CARBON DIOXIDE EQUIVALENT

Each of the GHGs reported in this inventory has a different level of impact on climate change. For example, the emission of 1 ton of N₂O has a global warming potential (GWP) 310 times larger than that of the emission of 1 ton of CO₂. Similarly, the emission of 1 ton of CH₄ has a GWP 21 times that of CO₂. To avoid confusion between emissions of the different types of gases and their respective GWPs, all emissions are reduced to the common unit of **CO₂e**, or **carbon dioxide equivalent**. Thus, the emission of 1 ton of N₂O is expressed as the emission of 310 tons of CO₂e. All results in this report will be presented in units of metric tons of CO₂e (MTCO₂e), unless otherwise noted.

Some equivalencies for 1 metric ton of carbon dioxide equivalent (CO₂e) include:

- Driving 2,000 miles in a car that averages 23 miles per gallon (e.g., 4 round trips between Cleveland and Cincinnati, 250 miles each way).
- Flying 3,700 miles by commercial airline (e.g., one round-trip from Cleveland to Las Vegas).

resulting from energy that is purchased by the City but generated elsewhere (primarily electricity from power plants), and **Scope 3** emissions are other indirect emissions that occur outside of the designated boundary as a result of the activities or demand generated by the City (**Table**).

One primary purpose of scopes is to prevent double counting emissions between reporting entities. For example, a power plant would report emissions from generating electricity as Scope 1, while consumers using that electricity would report those emissions as Scope 2.

Table 1: Inventory Sources

Scope 1	Scope 2	Scope 3
Natural Gas*	Purchased Electricity*	Employee Commuting
Fleet Fuel Consumption	Purchased Chilled Water*	City Financed Travel
	Purchased Steam*	Waste Generation (Solid Waste)

* Includes spaces where the City is the tenant

In addition to the municipal inventory sources outlined in the table above, there are other community-wide emissions for which the City has an influence (zoning and planning, complete and green streets, affordable housing, tree canopy, etc.) will be addressed in the community-wide CAP. These emission sources are not included here because they are not reflected in the City's organizational footprint.

Baseline Inventory

Using the guidance outlined above, a baseline GHG inventory was developed for the City's municipal operations. In 2010, total emissions for the City were over 400,000 MTCO₂e, with electricity consumption contributing approximately 84% of this total (**Figure 1**). This is equivalent to all City employees commuting from Cincinnati every day. Conversely, covering the City with trees seven times over would absorb this amount of CO₂e. Fifty percent of electricity consumption is attributed to the Department of Public Utilities, mainly due to the Division of Water's energy requirements for the treatment and distribution of water throughout the city (34%). Emissions associated with wastewater treatment are not included at this point because the city does not have direct operational control, and are considered Scope 3 emissions. Aviation fuels represent less than 0.01% of total emissions and were not included in the graphs (**Figure**).

Figure 1 : Annual GHG Emissions by Source

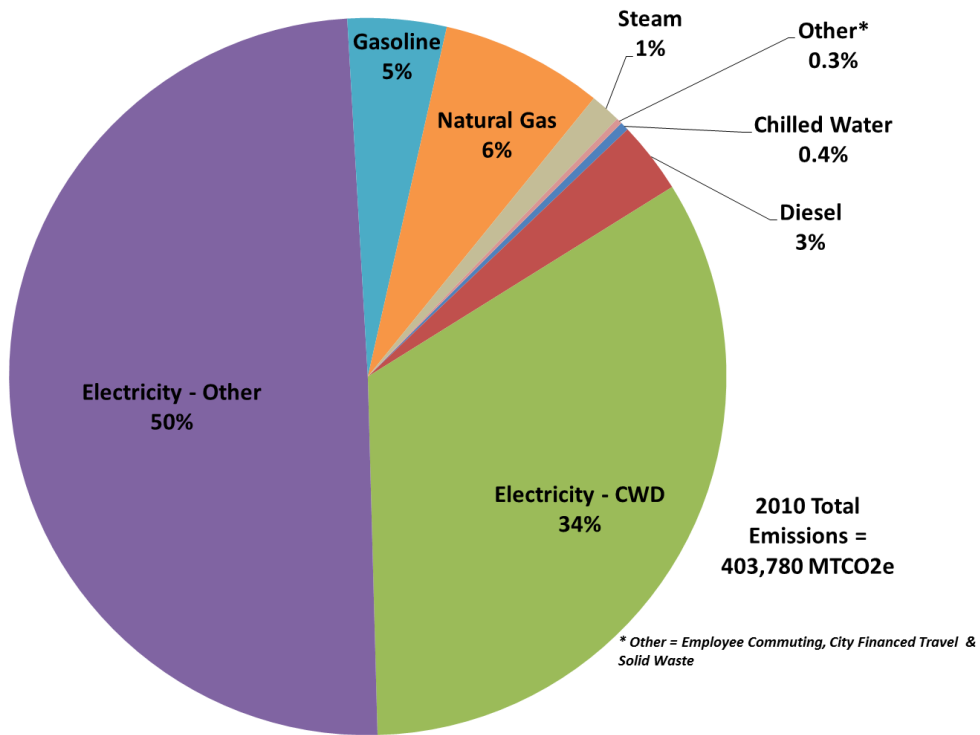
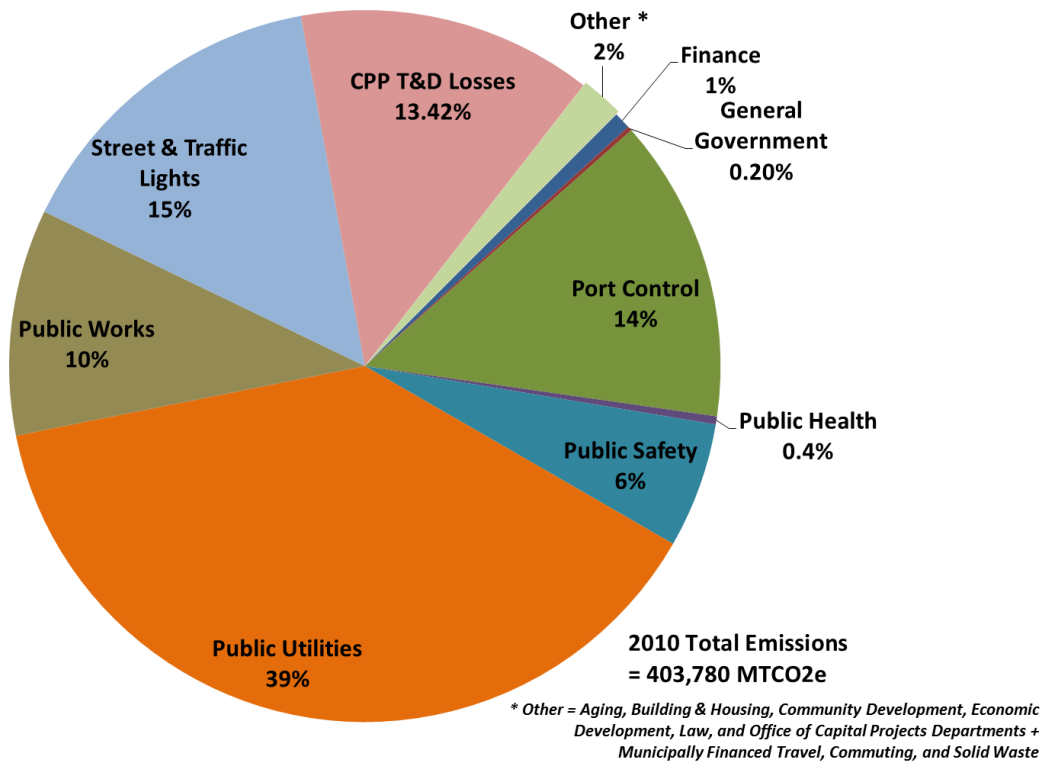
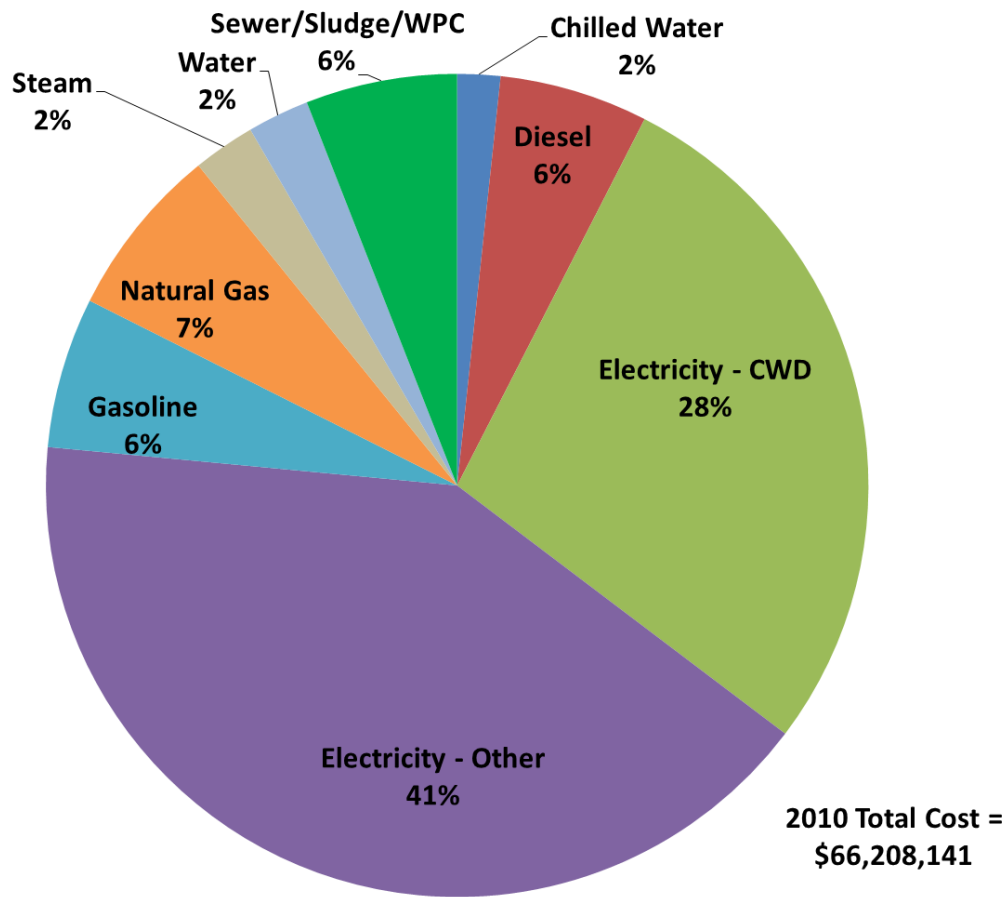


Figure 2: Annual GHG Emissions by City Department



In addition to GHG emissions, as part of the baseline inventory effort, annual costs for all utilities were analyzed. Total energy, transportation and water related costs for the City in 2010 were approximately \$66 million, shown in **Figure 3**. The city pays for sewer related charges and some of its water consumption, but not for solid waste disposal. However, all of water and sewer costs have been included to represent total utility costs if the City were to pay for all of its water consumption.

Figure 3: Annual Costs by Utilities



SC-MAP



A business-as-usual (BAU) forecast was prepared for the City of Cleveland municipal operations inventory from 2010 to 2030. This forecast is based on emissions today and does not account for possible changes in the number of Cleveland residents, City employees, City-owned buildings, etc., nor those that will occur as a result of changes in state or federal standards (e.g. increases in fleet fuel efficiency or likely reductions in the emissions intensity of electricity). This approach of assuming no growth or decline in emissions under the BAU approach can be adjusted in the future to account for any changes in City of Cleveland municipal operations.

Rising utility costs are a factor considered in this SC-MAP. **Table 2** outlines the assumed annual rate increases for each utility, as outlined by the [Energy Information Administration](#).

Table 2: Utility Cost Escalation

Utility	Annual Cost Increase
Electricity	0.2 percent
Natural Gas	1.4 percent
Water (2013-2015)	5.0 percent
Water (after 2015)	0.0 percent
Gasoline	0.8 percent
Diesel	1.1 percent

The SC-MAP contains an overarching GHG reduction goal (outlined in the sidebar to the right) that will be achieved through the implementation of the **25 actions** outlined in the plan. These actions are split into **5 focus areas** and have a total of **12 sub-goals**, all with the aim of reducing the City’s GHG emissions and making progress in sustainability.

Table 3 (**Table 3**) summarizes the estimated outcomes of implementation of all of the actions in the SC-MAP in terms of resource (energy, fuel, water) savings, GHG reductions, cost savings, and estimated capital costs. These outcomes are presented for the near-term and long-term. The two ‘Annual Savings in 2030’ columns represent the long-term impact of implementing each action. Cumulative costs and savings are not included here.

Average Annual Near-Term (2013-2016)

- Resource savings (per year): The type of resource savings depends on the action being pursued. Actions can result in decreased consumption of electricity (MWh), natural gas (MCF), gasoline and diesel (kgal), or water (MCF). Based on the expected resource savings, the resultant reduction in greenhouse gas emissions is also presented (MT CO2e).

SC-MAP GOAL

Goal 1: Greenhouse gas emissions reduction below 2010 baseline:

- 2016: 10%
- 2020: 20%
- 2030: 45%

- Cost savings (\$/year): Calculated based on the estimated resources savings for each action. More indirect savings such as reduced maintenance and increased wellness are not included in the analysis, although these are significant qualitative benefits.
- Cost (\$/year): Includes capital, implementation, and replacement costs. Ongoing operations and maintenance is not included.

Annual Savings in 2030

- Resource Savings: The cumulative resource savings of all actions implemented, presented on an annual basis for 2030.
- Net Cost savings (\$): The cumulative cost savings of all actions implemented, minus implementation cost, presented on an annual basis for 2030.

A separate spreadsheet contains more details on each calculation. As is discussed in each Focus Area section, these actions are anticipated to have several additional benefits that are difficult to quantify, from employee health and productivity to greater organizational coordination and efficiency.

Actions in the Design, Construction, and Maintenance and Materials Management and Procurement Focus Areas are not quantified as part of this plan due to lack of available data necessary for quantification. However, the write-up for each action in these focus areas does include a summary of potential costs and savings that can be used for further quantification as data becomes available.

Table 3: Cost Benefit Analysis

Action	Average Annual Near-Term (2013- 2016)			Annual Savings in 2030	
	Resource Savings (per yr)	Cost Savings (\$/yr)	Cost (\$/yr)	Resource Savings	Net Cost Savings (\$)
Design, Construction, and Maintenance					
DCM-1: Green Building for New Construction and Major Renovations	350 MWh 1,400 MCF 320 MT CO ₂ e	\$46,000	\$200,000	1,800 MWh 7,100 MCF 1,300 MT CO ₂ e	\$35,000
DCM-2: Capital Improvement Project Sustainability Review	<i>Detailed costs and benefits not included in the 2013 SC-MAP</i>				
DCM-3: Preventative Maintenance	<i>Detailed costs and benefits not included in the 2013 SC-MAP</i>				
DCM Subtotal	350 MWh 1,400 MCF (H₂O) 320 MT CO₂e	\$46,000	\$200,000	1,800 MWh 7,100 MCF (H₂O) 1,300 MT CO₂e	\$35,000
Energy					
E-1: Energy Efficiency in Existing Buildings	1,400 MWh 7,200 MCF 1,600 MTCO ₂ e	\$240,000	\$580,000	14,000 MWh 74,000 MCF 14,000 MTCO ₂ e	\$2.1 million
E-2: Energy Conservation in Existing Buildings	1,400 MWh 1,200 MTCO ₂ e	\$180,000	\$100,000	900 MWh 600 MTCO ₂ e	\$10,000
E-3: Building Automation System	1,000 MWh 2,800 MCF 1,000 MTCO ₂ e	\$160,000	\$760,000	2,900 MWh 15,000 MCF 2,800 MTCO ₂ e	\$430,000
E-4: Re-Commissioning Tune-Up	1,100 MWh 7,200 MCF 1,300 MTCO ₂ e	\$200,000	\$640,000	6,500 MWh 42,000 MCF 6,700 MTCO ₂ e	\$650,000
E-5: Cleveland Division of Water System Pumping and Treatment Optimization	21,000 MWh 18,000 MT CO ₂ e	\$1.8 million	\$830,000	38,000 MWh 26,000 MT CO ₂ e	\$3.3 million
E-6: Streetlight Upgrades	1,200 MWh 1,000 MTCO ₂ e	\$100,000	\$440,000	20,000 MWh 13,000 MTCO ₂ e	\$300,000

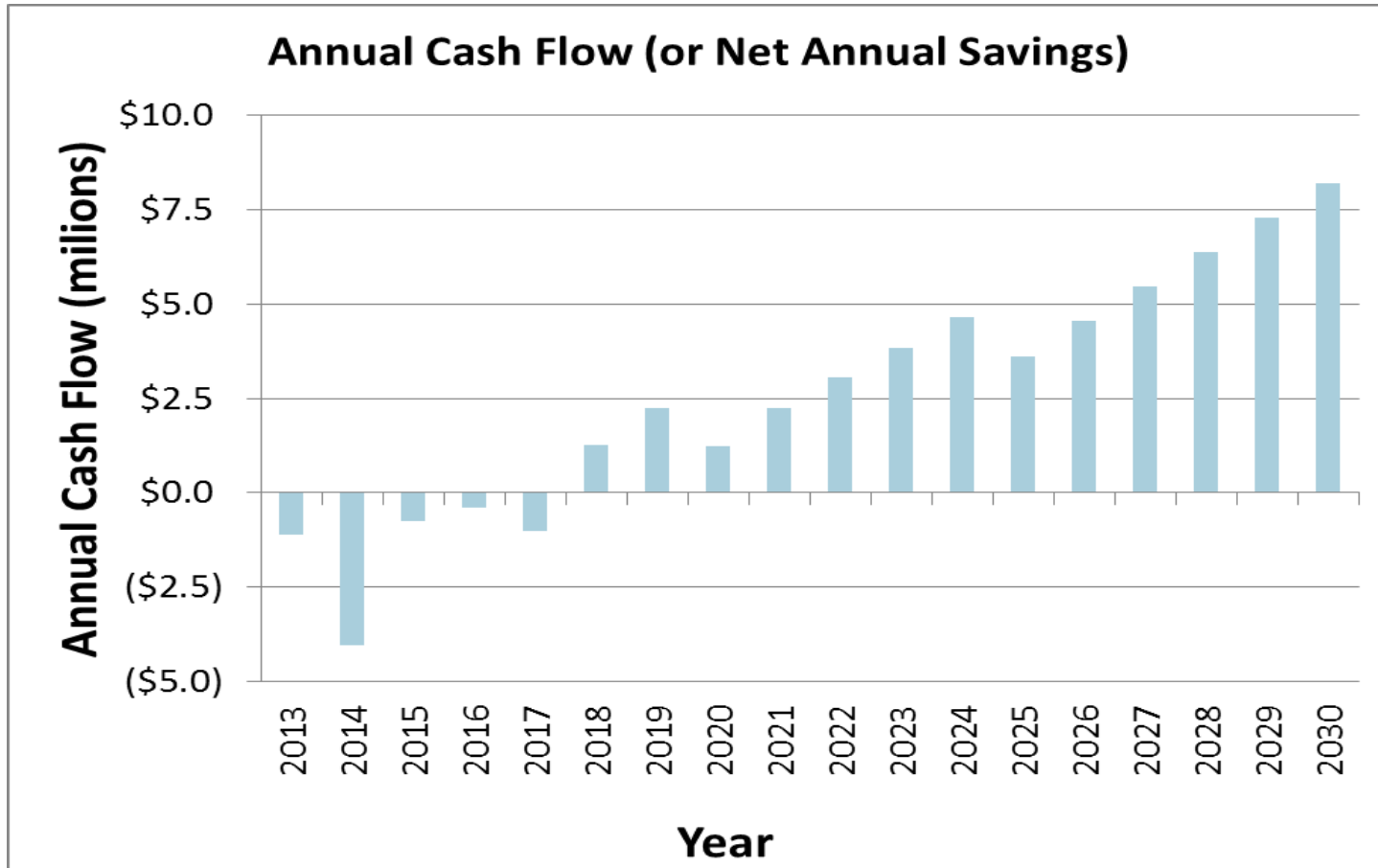
Action	Average Annual Near-Term (2013- 2016)			Annual Savings in 2030	
	Resource Savings (per yr)	Cost Savings (\$/yr)	Cost (\$/yr)	Resource Savings	Net Cost Savings (\$)
E-7: Renewable Energy	430 MWh 92 MCF 360 MTCO ₂ e	\$56,000	\$490,000	19,000 MWh 5,800 MCF 13,000 MTCO ₂ e	(\$460,000)
E-8: Cleveland Public Power’s Advanced Energy Portfolio	17,000 MT CO ₂ e	N/A	N/A	98,000 MT CO ₂ e	N/A
E-9: Smart Savings	TBD	TBD	TBD	TBD	TBD
Energy Subtotal	27,530 MWh 17,292 MCF 41,460 MTCO₂e	\$2.7 million	\$3.8 million	101,300 MWh 136,800 MCF 174,000 MTCO₂e	\$6.3 million
Transportation					
T-1: Green Employee Commuting	21,000 gal 180 MTCO ₂ e	N/A	\$50,000	130,000 gal 1,100 MTCO ₂ e	(\$310,000)
T-2: Green Business Travel	84,000 gal 790 MTCO ₂ e	\$330,000	\$560,000	360,000 gal 3,400 MTCO ₂ e	\$1.4 million
T-3: Vehicle Replacement and Repower	47,000 gal 190 MTCO ₂ e	\$99,000	\$270,000	340,000 gal 1,200 MTCO ₂ e	\$490,000
T-4: Anti-idling Enforcement	61,000 gal 590 MTCO ₂ e	\$240,000	\$220,000	170,000 gal 1,700 MTCO ₂ e	\$780,000
Transportation Subtotal	213,000 gal 1,750 MTCO₂e	\$669,000	\$1.1 million	1,000,000 gal 7,400 MTCO₂e	\$2.35 million
Water					
W-1: Water Efficiency	290 MCF 5 MT CO ₂ e	N/A	\$25,000	5,400 MCF 70 MT CO ₂ e	(\$51,000)
W-2: Water Conservation	1,500 MCF 23 MT CO ₂ e	N/A	\$51,000	5,700 MCF 70 MT CO ₂ e	(\$14,000)
W-3: Water Reuse and Recycling	6 MCF	N/A	\$210,000	0 MCF 1 MT CO ₂ e	(\$250,000)

Action	Average Annual Near-Term (2013- 2016)			Annual Savings in 2030	
	Resource Savings (per yr)	Cost Savings (\$/yr)	Cost (\$/yr)	Resource Savings	Net Cost Savings (\$)
W-4: Cleveland Division of Water System Loss Minimization and Meter Installation*	260 Mgal 630 MWh 540 MT CO ₂ e	N/A	TBD	2,600 Mgal 6,300 MWh 4,300 MT CO ₂ e	TBD
W-5: On-Site Stormwater Management	N/A	\$1,000	\$12,000	N/A	(\$190,000)
Water Subtotal *	1796 MCF 630 MWh 568 MT CO₂e	\$1,000	\$298,000	11,100 MCF 6,300 MWh 4,441 MT CO₂e	(\$505,000)
Materials Management and Purchasing					
M-1: Overall Waste Reduction	<i>Detailed costs and benefits not included in the 2013 SC-MAP</i>				
M-2: Increased Recycling in City Buildings	<i>Detailed costs and benefits not included in the 2013 SC-MAP</i>				
M-3: Compost Program for City Buildings	<i>Detailed costs and benefits not included in the 2013 SC-MAP</i>				
M-4: Sustainable Purchasing	<i>Detailed costs and benefits not included in the 2013 SC-MAP</i>				
Materials Subtotal	<i>Detailed costs and benefits not included in the 2013 SC-MAP</i>				
TOTALS	29,000 MWh 17,300 MCF (NG) 210,000 gal 3,200 MCF (H₂O) 44,000 MTCO₂e	\$3.4 million	\$5.4 million	110,000 MWh 140,000 MCF (NG) 1,000,000 gal 11,000 MCF (H₂O) 190,000 MTCO₂e	\$8.2 million

* Addressing loss minimization throughout the CWD delivery system will result in water savings. This estimated savings is not shown here, although it represents savings for the entire CWD service area and not just City municipal operations. Cost information is not available for this implementation, hence savings are not documented.

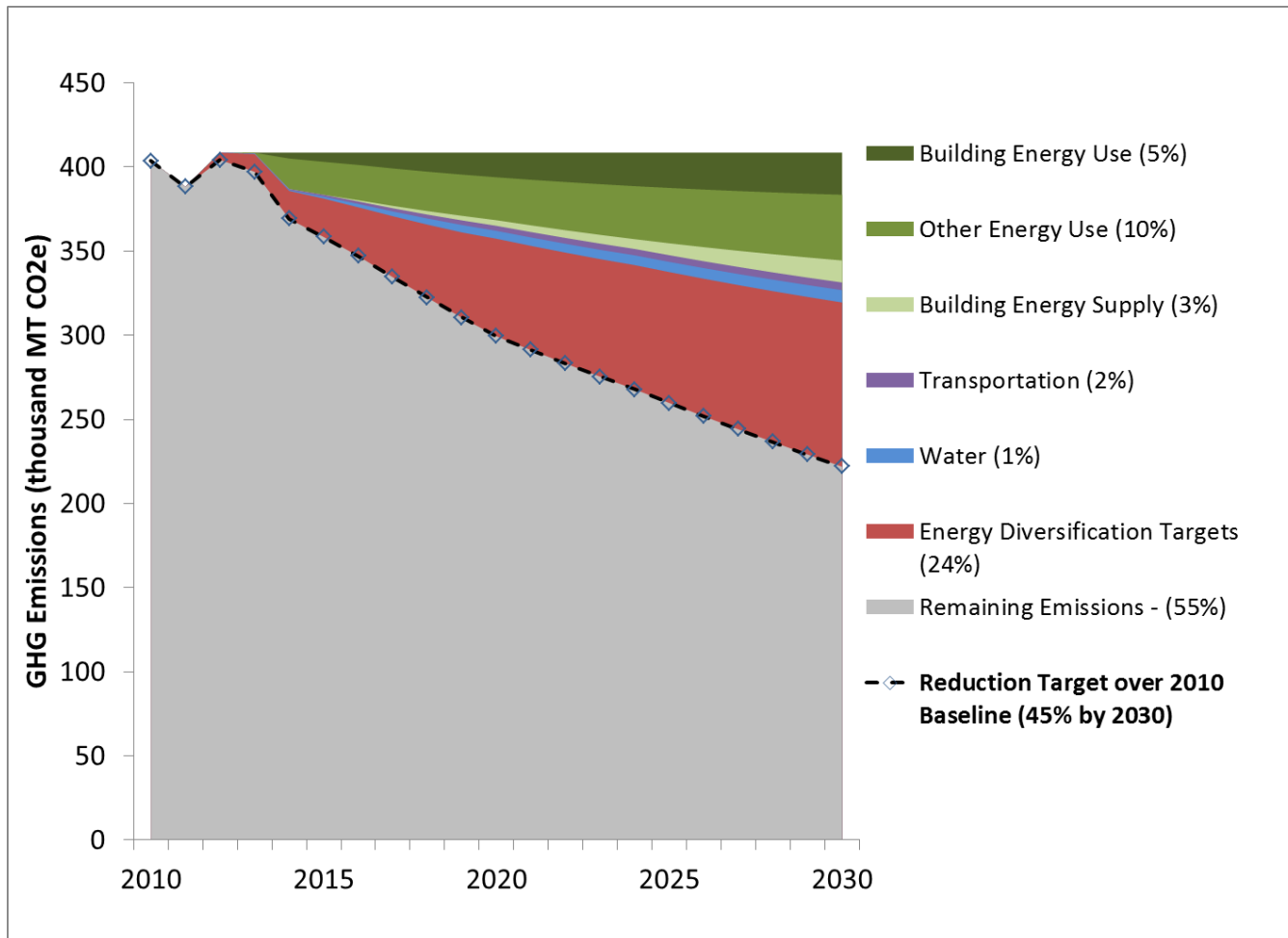
Figure 4 presents the annual net cash flow for all actions included in the SC-MAP. In the first five years of plan implementation upfront investment will be required to implement projects and begin to realize cost savings. A large portion (over 40%) of the investment required by 2014 is for CWD energy management, which has already been identified in the 2012 Capital Improvement Plan. After 2017, on an annual basis, cost savings from previously implemented projects will exceed the capital required for additional project implementation.

Figure 4 : Annual Cash Flow through 2030



In addition to resource and cost savings, the SC-MAP’s 25 actions also combine to reduce the overall carbon footprint of City operations. **Figure 5** shows the GHG emission reductions expected as a result of these actions. The percentages shown represent the reduction below the 2030 business-as-usual forecast for each action. The total percent reduction for all actions is estimated at **45% below the 2010 baseline by 2030**.

Figure 5: GHG Emissions Reductions



SC-MAP FOCUS AREA 1: DESIGN, CONSTRUCTION, AND MAINTENANCE

Why are Design, Construction, and Maintenance Important?



Buildings are major users of energy in Cleveland and nationwide. According to the U.S. Energy Information Administration, in 2010 buildings consumed approximately 41% of the nation's total energy and accounted for nearly 40% of carbon dioxide (CO₂)

emissions. There are significant opportunities in Cleveland's municipal facilities to not only save money and use energy more efficiently, but also to advance other aspects of high-performance buildings. Well-designed new buildings and renovations are resource efficient, use renewable and recycled building materials, create healthy working environments, reduce building operating costs, and help reduce GHG emissions. Such concepts can also be applied to other capital projects and municipal infrastructure.

Current Actions

The City of Cleveland is already taking steps to address this focus area, including:

- Leadership in Energy and Environmental Design (LEED) facilities:
 - Collinwood Recreation Center (LEED Gold, 2011, certified)
 - Kirtland Pump Station (LEED Silver, 2010, certified)
 - The Bike Rack, featuring 50 bicycle storage facilities, showers, and related facilities for commuters (2011, certification in process)
 - East Side Storage Facility, 3rd District Police Station and a New Fire Station #36 (in development)
- The Technology and Security Building has incorporated some green building elements, but did not pursue LEED certification.
- Joined the Cleveland 2030 District (C2030D) and the Better Buildings Challenge (BBC) in May 2012. As part of the BBC, the City of Cleveland has committed to publicly share its energy data and reduce its building energy usage 20% by 2020, using a 2010 baseline. The BBC targets serve as a "stepping stone" to meet C2030D targets of 50% reduction by 2030.

DESIGN, CONSTRUCTION, AND MAINTENANCE GOALS

Goal 1: Sustainable Building Policy implemented across all departments

- 2013: LEED Silver for New Construction and Major Renovations, plus other requirements
- 2016: LEED Gold for New Construction and Major Renovations, plus other requirements
- 2020: BBC goals
- 2030: Cleveland 2030 District targets



DCM-1: Green Building for New Construction and Major Renovations

Action: Adopt and implement a Sustainable Building Policy which requires the incorporation of green building practices into the siting, design, construction, remodeling, repair, maintenance, operation, and deconstruction of all City facilities whenever feasible, organized into the following three building types:

- New construction and major renovations
- Tenant improvements and leased spaces
- Existing buildings and “Fix it First” projects

The policy should outline criteria for each of these scenarios including building type/size, building design guidelines (e.g., LEED Silver), energy savings targets, goals for equipment/system repairs/replacement, and budget/financial considerations.

Costs and Benefits

Costs for this strategy include the additional upfront cost to achieve sustainable design. These costs vary for each project, but for the average LEED Silver project, expect an average of a 1% cost premium.

Benefits for this strategy include reduced resources use; lower utility and operation and maintenance (O&M) costs; and improved human health, comfort, and productivity for building occupants. According to U.S. Green Building Council, a 30% reduction of energy and water use and long-term savings in utility and maintenance costs over the life of the facility more than offset any additional upfront cost.

Green Building for New Construction and Major Renovations

Performance Indicators:

- LEED certified buildings owned or leased (#, square feet)
- Projects that meet or exceed the Sustainable Building Policy
- LEED Accredited Professionals (APs) or LEED Green Associates (# City employees)
- Departments or Divisions with at least one LEED AP/GA

Lead(s):

- Mayor’s Office of Capital Projects, Division of Architecture and Site Development
- DPW, Division of Property Management and Enterprise Funds
- Office of Sustainability

Related Actions:

- DCM-2: Capital Improvement Project Sustainability Review
- DCM-3: Preventative Maintenance
- Many other actions related to sustainable building

Average Annual Near-Term (2013-2016)			Annual Savings in 2030	
Resource Savings (per yr)	Cost Savings (\$/yr)	Cost (\$/yr)	Resource Savings	Net Cost Savings (\$)
350 MWh 1,400 MCF 320 MT CO ₂ e	\$46,000	\$200,000	1,800 MWh 7,100 MCF 1,300 MT CO ₂ e	\$35,000

Next Steps (2013-2015)

1. Begin implementation of the City's Sustainable Building Policy.
2. Ensure policy is implemented by incorporating into Capital Improvement Project planning and review (see DCM-2).
3. Provide training to staff on Sustainable Building Policy. Continue to make available LEED training for all City employees, and the opportunity for LEED accreditation to select individuals.

DCM-2: Capital Improvement Project Sustainability Review

Action: Incorporate sustainability and a systems thinking approach into the planning, decision-making, and design process for capital improvement projects, expanding upon the City’s current efforts in sustainable building.

The City’s 2012 Five Year Capital Improvement Program includes issuance of \$38 million in additional general obligation bond debt in 2012 for a wide range of projects. Well over 10% of the 2012 Capital Budget is dedicated to projects that will directly make Cleveland a more sustainable community. Many other projects have the opportunity to indirectly improve the City’s sustainability performance.

Sustainable Infrastructure can be defined as, “a decision-making framework for capital spending that links asset management to an interest in green outcomes and an understanding that the most effective capital investments may require non-traditional alternatives and integrate efforts across department silos and lines of business.” This approach often includes a triple bottom line framework for construction and operation, where project options are compared based on consistent environmental, social and economic metrics.

Such approaches also include a more holistic approach to cost accounting including use of an asset management system for life cycle analysis, examining project costs from pre-construction to decommissioning to factor into decision making considerations such as durability, operations and maintenance costs, and end-of-life project costs. It also includes “Full Cost Accounting” – i.e., inclusion of both the City’s direct and indirect project costs, especially initial overhead and administrative costs associated with project development. These include project planning, design, property acquisition, environmental review, permitting, contingency allowance, project management, and closeout activities.

Costs and Benefits

This action is process-based, so costs for implementation are minimal. While no specific cost savings value can be assigned to a sustainable infrastructure process, sharing information and fostering collaboration can help optimize the value of capital projects, reduce unnecessary costs associated with siloed approaches to project planning, and result in more accurate project cost estimates. When investments in one infrastructure system routinely provide multiple benefits, the City can get more value for each dollar spent. Decentralized alternatives to large capital projects that are often identified during a sustainable infrastructure process are inherently smaller in scale than centralized infrastructure and often can be constructed in appropriately sized, cost-effective increments as demand justifies the

Capital Improvement Project Sustainability Review

Performance Indicators:

- Projects screened with triple bottom line tool
- Consultant Review Committee (CRC) reviews that incorporate sustainability
- Improved capital project cost estimates that incorporate life-cycle energy and sustainability costs/savings

Lead(s):

- Mayor’s Office of Capital Projects
- Operations
- Office of Sustainability

Related Actions:

- DCM-1: Green Building for New Construction and Major Renovations
- DCM-3: Preventative Maintenance

investment. Strategic investments in such decentralized options can also eliminate or significantly delay the necessity for costly expansion of traditional infrastructure systems. Collaboration among stakeholders is important so that the design and construction of decentralized alternatives can be coordinated.

Next Steps (2013-2015)

1. Establish a mechanism for incorporating sustainability into the Consultant Review Committee (CRC) process. This could include development of a short checklist that is used for projects that significantly impact the City's sustainability performance.
2. Develop Complete and Green Streets typology, design manual and prioritization matrix, currently in process.
3. Building off of the LEED framework for City buildings and the Complete and Green Streets prioritization matrix, make available a simple triple bottom line tool that staff can use in evaluating other capital projects using environmental, community, and economic factors. This could be linked to the community Climate Action Plan completed in 2013, so that City infrastructure projects contribute to community goals.
4. Develop a life-cycle and total cost approach looking at all cycles from pre-construction to de-commissioning. This includes re-visiting the current practice of allocating a fixed budget for capital project design and construction without considering energy and sustainability measures that will yield life-cycle savings.
5. Ensure that asset management tools being developed by City departments remain compatible with the City's sustainable infrastructure approach to capital spending and are included in project budgets where appropriate.

DCM-3: Preventative Maintenance

Action: Establish a City-wide preventative maintenance program to better evaluate replacement/maintenance options. Establish a dedicated preventative maintenance staff to maintain high performance in existing building systems, thereby saving money in utility costs and by delaying or preventing costly repair and replacement.

This action is consistent with the Mayor’s “Fix it First” approaches to City facilities. In 2011, the City began prioritizing the repair and replacement of existing facilities. These repairs can help the City meet its energy reduction and sustainability goals by focusing on repairs and replacement of equipment, such as HVAC equipment, appliances, and plumbing and water fixtures.

A preventative maintenance program complements an asset management approach for City assets by providing a system to improve overall efficiency of these assets.

Costs and Benefits

Life-cycle savings are typically greater than added labor and material costs associated with the implementation of a preventative maintenance program. According to the U.S. Environmental Protection Agency and U.S. Department of Energy, procedures specifically targeted at HVAC and lighting systems, for example, can save 5% to 20% on energy bills annually without significant capital investment. Other benefits include improved occupant health and comfort and reductions in major repair and replacement of equipment.

Next Steps (2013-2015)

1. Establish a Sustainable Building Committee, as part of the City’s Green Team, to identify maintenance issues, resolve concerns, and inform practices and procedures. The committee should include representatives from various departments from both the enterprise and general funds, to address all relevant concerns.
2. Establish the scope of preventative maintenance activities, documenting those activities that are already completed or underway, as well as those referenced in the Sustainable Building Policy.
3. Develop and implement a Preventative Maintenance Program proposal, including a Master Maintenance and Staff Training Plan, which identifies projected costs and savings. Include a process for ensuring that future additions and renovations adhere to high performance standards.
4. Monitor maintenance and operational costs of the City’s sustainable buildings.

Preventative and Predictive Maintenance

Performance Indicators:

- Equipment covered by preventative maintenance program
- Total annual building maintenance costs (per square foot)
- Energy cost savings from high-performing facilities and equipment
- Building occupant complaints related to indoor air quality and thermal comfort

Lead:

- Department of Public Works, Division of Property Management and Enterprise Funds

Related Actions:

- DCM-1: Green Building for New Construction and Major Renovations
- DCM-2: Capital Improvement Project Sustainability Review
- E-4: Building Automation Systems

SC-MAP FOCUS AREA 2: ENERGY

Why is Energy Important?



Related to the Design, Construction, and Maintenance Focus Area, energy efficiency and conservation are often the most cost-effective approaches for reducing emissions and energy costs in municipal buildings. The City of Cleveland spends more

than \$50 million annually on energy and utilities for its own operations. There are numerous opportunities to significantly reduce these costs through cost-effective energy efficiency and conservation measures. Now is the time to take advantage of these opportunities by building off of recent progress in data collection and energy project implementation to scale up the City's energy efficiency program. Energy conservation, energy efficiency, and renewable energy projects can all be applied to existing buildings and infrastructure, as well as the operation of new high efficiency buildings.

The following framework has been used to develop short-term opportunities for action. This framework allows for the implementation of further short-term opportunities that are not listed in this document.

- Utilize and expand on EnergyCAP, the Utility and Energy Data Management System being implemented across all City departments.
- Utilize data from existing energy audits, completed projects, prior facilities assessments, and the City's LEED buildings to generate project opportunities not already covered by the Energy Efficiency and Conservation Block Grant (EECBG) program or other City department projects.
- Take into account the facilities contraction analysis. Expand on coordination with property management, facility managers, Division of Architecture and Site Development, Finance, and others.
- Take advantage of improved energy data by exploring opportunities for "supply side management", such as utility rate negotiations, terminations of inactive city accounts, and application of utility rebates.

ENERGY GOALS

Goal 1: Total energy reduction below 2010 baseline

- 2016: 5%
- 2020: 10%
- 2030: 20%

Goal 2: Building energy reduction below 2010 baseline

- 2016: 10%
- 2020: 20%
- 2030: 50%

Goal 3: Percent of City total energy use by on-site renewable energy

- 2016: 1%
- 2020: 2%
- 2030: 5%

Goal 4: Meet CPP's Advanced Energy Portfolio Standard (AEPS) goals

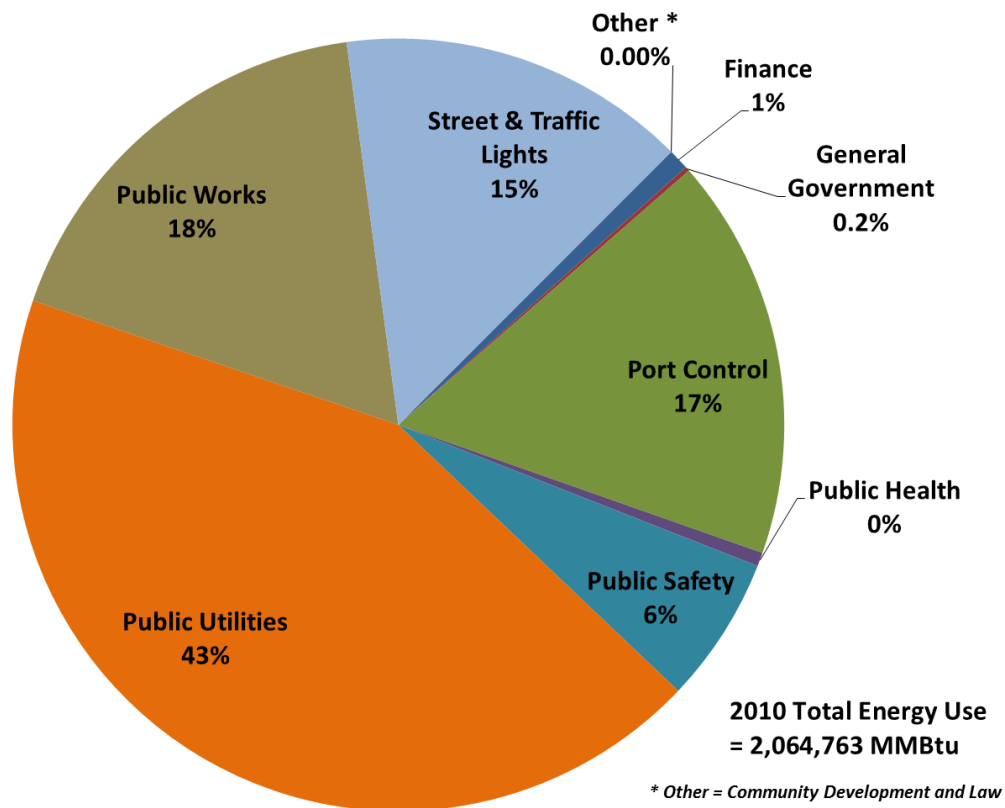
- 2015: 15%
- 2020: 20%
- 2025: 25%

- Reduce indirect energy costs associated with water, sewer, waste and recycling, etc.
- Pilot projects with proven alternative innovative financing mechanisms, such as energy performance contracting and Property Assessed Clean Energy (PACE) financing. Explore opportunities for developing an energy revolving loan fund for City operations.
- Review ongoing facility maintenance processes and procedures to reveal no cost/low cost opportunities.

Current Actions

In 2010, total energy use by City municipal operations was over 2 million MMBtu (**Figure 6**), with the largest percentage (43%) coming from the Public Utilities department of which CWD is the largest contributor. The City of Cleveland joined the Cleveland 2030 District and the Better Buildings Challenge in May 2012. As part of the Challenge, the City of Cleveland has committed to publicly share its energy data and reduce its building energy usage 20% by 2020, using a 2010 baseline. Additionally, in June 2008, the City of Cleveland adopted a Citywide Advanced Energy Portfolio Standard (AEPS) to ensure that 15% of Cleveland Public Power’s energy comes from advanced or renewable sources by 2015, 20% by 2020, and 25% by 2025.

Figure 6: Annual Energy Use by City Department



The City has initiated several energy and sustainability projects for City buildings and municipal operations, some of which are listed below:

Energy Efficiency and Conservation

- An organization-wide energy and utility data management system (EnergyCAP)
- Energy assessments completed at five major facilities
- HVAC upgrades at 14 fire stations to provide more energy efficient infrared heating
- Lighting retrofits in 24 municipal buildings to date
- LED streetlights installation on city streets beginning in Q1 2013 (The Airport has already completed a couple projects)

Advanced and Renewable Energy

- Solar hot water system installed at Collinwood Recreation Center
- Rockefeller Greenhouse Solar Demonstration (modules track/rotate throughout the day)
- Cleveland Public Power purchases energy from the Collinwood BioEnergy facility
- Wind resource monitoring at two potential sites (2010-11)
- Creation of a Wind Turbine Zoning Ordinance (2009)

E-1: Energy Efficiency in Existing Buildings

Action: Significantly reduce energy consumption, demand and cost across all City departments through energy efficiency.

As part of the Better Buildings Challenge (BBC), the City of Cleveland has committed to reduce energy use from buildings 20% by 2020. Cleveland 2030 District (C2030D) targets culminate in a 50% energy use reduction goal in existing buildings by 2030. This action focuses on opportunities for energy conservation measures (ECMs) in existing buildings to help the City meet this goal. Typical ECMs address, but are not limited to, building envelope, lighting, HVAC equipment, and domestic water heating and consumption. This strategy assumes that once all buildings have been assessed and upgraded that additional efficiency improvements will be made on a 10 year cycle.

Costs and Benefits

Costs include those related to energy assessments (audits) and ECM implementation that may include new, high-efficiency equipment costs. Benefits ultimately include increased efficiency and cost savings relative to higher performing buildings. Specific costs and benefits will vary by strategy and can be refined through the building assessment process.

Given budget constraints, alternative financing will likely be necessary to make significant reductions in the City's building energy usage. For energy efficiency, this often takes the form of energy performance contracts. "Performance contracting" is a proven method of obtaining energy conservation measures, including design, installation, financing, and maintenance services, without initial capital expense. These contracts fund building improvements out of existing utility operating dollars. Such funding allows the City to take advantage of cost saving projects that might otherwise be foregone. Property Assessed Clean Energy (PACE) financing can perform a similar function as energy performance contracting.

There are other financing opportunities available including development of an Energy Revolving Loan Fund (RLF) for municipal operations. The purpose of a RLF is to finance projects that deliver energy and water savings without increasing general fund expenses after initial funding. As the financial savings accumulate from the initial projects, these funds would be reallocated to other projects and perpetuate the revolving door of financial savings and environmental improvements for the City's operations. The result is a source of sustainable funding for reinvestments in municipal energy projects.

To estimate the potential savings and related costs through the 2030 planning horizon, it was assumed that approximately 10% of City building space would be upgraded annually in the near term, doubling the implementation rate starting in 2017 (20% of building space annually), using savings realized in the first four years of implementation to pay for the more aggressive implementation rate. It has also been assumed that an average 10% savings could be realized for each building. For each round of upgrades, a

Energy Efficiency in Existing Buildings

Performance Indicators:

- Facility Assessments and efficiency upgrades (%)
 - 2016: 10% of City square footage assessed and upgraded
 - 2020: 20% of City square footage assessed and upgraded

Lead(s):

Office of Sustainability, DPU, DPC, DPW, Finance

Related Actions:

- E-2: Energy Conservation in Existing Buildings
- E-3: Building Automation Systems
- E-4: Re-commissioning/ Tune-up

one-time implementation cost was estimated assuming an average 5 year payback for efficiency projects.

Average Annual Near-Term (2013-2016)			Annual Savings in 2030	
Resource Savings (per yr)	Cost Savings (\$/yr)	Cost (\$/yr)	Resource Savings	Net Cost Savings (\$)
1,400 MWh 7,200 MCF 1,600 MTCO ₂ e	\$240,000	\$580,000	14,000 MWh 74,000 MCF 14,000 MTCO ₂ e	\$2.1 million

Next Steps (2013-2015)

1. As part of the BBC, make energy use data in City buildings publicly available by December 2012, and update annually. This requires cooperation from all departments to ensure data completeness and quality.
2. Develop a system to track progress (possibly through the use of ENERGY STAR Portfolio Manager) by cataloging energy audits, facility assessments, energy efficiency / building renovation and upgrades projects, planned projects, etc.
3. Prioritize all City buildings for energy assessments based on a set of key criteria, such as:
 - a. Energy use intensity
 - b. Estimated energy savings potential
 - c. Visibility
 - d. Need for repair
 - e. Contraction Analysis
4. Conduct energy assessments on at least five (5) City-owned facilities. This should be done in conjunction with building assessments as part of Action W-1. Evaluate outcomes of energy assessments and prioritize implementation based on results. To help in this effort, opportunities should be evaluated based on estimated energy and cost savings, implementation cost, priorities for that building, etc.
5. Integrate energy efficiency into planned buildings upgrades when cost-effective. In addition, research the potential of an Energy Revolving Loan Fund (RLF) and other funding options for the City of Cleveland.
6. Apply for utility rebates (e.g. Efficiency \$mart) for ongoing and recently completed energy efficiency projects.

E-2: Energy Conservation in Existing Buildings

Action: Reduce energy use in City buildings through no- and low-cost conservation measures.

In addition to energy efficiency, conservation is crucial to meeting the BBC and C2030D goals. While efficiency focuses on equipment upgrades, energy conservation targets opportunities for reducing energy end-use by employees through education campaigns, incentive programs, etc.

Examples of engaging employees in no-cost and low-cost energy conservation measures include:

- Where occupancy sensors are not installed, switch lights off when space not in use/last to leave.
- Unplug space heaters and fans where possible.
- Consolidate office equipment where possible, such as the use of multi-function copiers.
- Set printers to print duplex by default, eco-mode whenever possible, etc.
- Use thermostat settings and occupancy sensors as intended.
- Conduct preventative maintenance of equipment (see DCM-3).

Energy Conservation in Existing Buildings

Performance Indicators:

- Employees trained in sustainability and energy conservation practices (%)
- Building dashboards installed
- Sustainability Champions assigned to each major building

Lead(s):

- Office of Sustainability

Related Actions:

- DCM-3: Preventative Maintenance
- E-1: Energy Efficiency in Existing Buildings
- E-3: Building Automation Systems

Costs and Benefits

Costs for this action are fairly minimal, limited largely to resources to develop educational/training materials for City employees (webinars, signage, etc.) and data analysis tools that make energy and water use visible in real time for building users. This action assumes that City personnel would be responsible for developing and delivering the education/training programs, with materials (e.g., signage) produced by the Division of Printing and Reproduction. Based on case studies from other education and behavioral efforts a 5% energy savings can typically be realized through conservation programs.

Average Annual Near-Term (2013-2016)			Annual Savings in 2030	
Resource Savings (per yr)	Cost Savings (\$/yr)	Cost (\$/yr)	Resource Savings	Net Cost Savings (\$)
1,400 MWh 1,200 MTCO ₂ e	\$180,000	\$100,000	900 MWh 600 MTCO ₂ e	\$10,000

Next Steps (2013-2015) – In conjunction with Action W-2

1. Install technology to visually display real-time building energy (and water) use, similar to a building dashboard. As a Cleveland 2030 District member, the City may have access to a web-based building dashboard to be developed by a third party consultant.

2. Hold quarterly Sustainability 101 trainings available to all City employees. Explore the possibility of making a one-hour Sustainability 101 training mandatory for all City employees.
3. Establish efficiency accounts so a portion of the cost savings from efficiency efforts goes back to that department/division, or an Energy Revolving Loan Fund, rather than the City's General Fund.
4. Consider holding an Energy Office Challenge, or other incentive programs, to encourage conservation across all City departments.
5. Utilize City Green Team as ambassadors for each department to educate employees on energy conservation measures. Green Team to identify Sustainability Champions at each major building.

E-3: Building Automation Systems

Action: Install new Building Automation Systems (BAS) for City buildings with high energy use or complex systems, and fully utilize existing systems.

The City has approximately 175 buildings and 7 currently have a building automation system (BAS) or some form of direct digital control including: Collinwood Recreation Center, McCafferty Health Center, J Glenn Smith Health Center, Gunning Recreation Center, JL Stamps Service, City Hall (partial), Downtown Safety Center, and 205 St. Clair Building. Cleveland Hopkins Airport also has three different automation systems to control HVAC and lighting. A BAS provides centralized control and monitoring of buildings systems that affects electricity demand and use, heating, cooling, ventilation, motors, lighting, and other equipment. A BAS is typically computer-based and can often be accessed remotely over a network to facilitate monitoring and troubleshooting. A BAS should include robust trending capabilities for logging system parameters and electricity to establish a baseline to track operations and improvements. A BAS and the trending logs can be used to reduce energy usage, implement electricity demand control, increase overall efficiency, and facilitate control and maintenance of the heating and cooling systems.

Costs and Benefits

Initial BAS installation costs can be around \$0.75 to \$1.00 per square foot or 20% to 30% of one year's utility costs. Cost varies depending on the building, existing infrastructure, and BAS capabilities. Annual maintenance costs are not required if the on-site maintenance staff can effectively maintain the system. However, some building owners opt to have a maintenance agreement with a temperature control company and/or pay for annual software upgrades. A BAS implementation can often save 5% to 10% on utility costs. Additional benefits can include reduced maintenance costs and reduced staff time for trouble shooting problems.

When considering which buildings might be good candidates for BAS implementation, the following is a list of city-owned buildings, grouped by square footage.

Building Automation System

Performance Indicators:

- Building square feet controlled by BAS (in addition to current systems)
 - 2016: All buildings over 100,000 square feet (~\$3M sq. ft total)
 - 2020: All buildings over 50,000 square feet (~850,000 sq. ft total)
 - 2030: All buildings over 10,000 square feet (~1.5M sq ft total)

Lead(s):

- Mayor's Office of Capital Projects, Division of Architecture
- DPW, Division of Property Management

Related Actions:

- DCM-1: Green Building in New Construction and Major Renovation
- DCM-3: Preventative Maintenance
- E-1: Energy Efficiency in Existing Buildings
- E-4: Re-commissioning/Tune-up
- W-1: Water Efficiency in Existing Buildings

Summary of City-owned Buildings	
Building Size	Number
> 100,000 sq. ft.	11
> 50,000 but < 100,000 sq. ft.	13
> 10,000 but < 50,000 sq. ft.	57

Average Annual Near-Term (2013-2016)			Annual Savings in 2030	
Resource Savings (per yr)	Cost Savings (\$/yr)	Cost (\$/yr)	Resource Savings	Net Cost Savings (\$)
1,000 MWh			2,900 MWh	
2,800 MCF	\$160,000	\$760,000	15,000 MCF	\$430,000
1,000 MTCO _{2e}			2,800 MTCO _{2e}	

Next Steps (2013-2015)

1. Review existing BAS systems and effectiveness of the systems, installation, and operation through the re-commissioning process (see Action E-4).
2. Select two City facilities to pilot BAS implementation. Some possible facilities include:
 - Police Headquarters
 - City Hall (partial BAS currently exists)
 - Burke Airport
 - Cleveland Hopkins Airport (partial BAS currently exists)
3. Select BAS vendor(s) and open architecture systems (i.e. BACnet vs. proprietary).
4. Install and commission systems and provide staff training.
5. Ensure implementation of the City's Sustainable Building Policy requirement for BAS on all large new construction and renovations (see Action DCM-1).

E-4: Re-Commissioning Tune-Up

Action: Establish a building re-commissioning and tune-up program that achieves electricity, natural gas, and water savings by implementing low- and no-cost measures, while improving facility operation and maintenance.

The main objective is to make existing systems work as efficiently as possible. The City has approximately 175 buildings, of which the majority (85%) is less than 50,000 square feet. These existing buildings can be tuned-up, or re-commissioned, through a process of systematically evaluating facility systems.

For greatest cost effectiveness, this action involves a more traditional re-commissioning approach for larger buildings with complex HVAC (including building automation systems) and lighting control systems, and a streamlined tune-up approach for buildings with less complex systems such as packaged rooftop units. It assumes that once all buildings have been re-commissioned/tuned-up, the City will continue evaluating and improving its systems on a 10-year cycle.

Costs and Benefits

Re-commissioning costs are typically around \$1.00 per square foot, which includes implementing the recommendations. Tune-up costs are in the range of \$0.20 to \$0.30 per square foot, including implementation. Re-commissioning can save 5% to 15% on a building’s utility costs, improve understanding of building systems, reduce maintenance costs, and increase occupant comfort. This action assumes the City will re-commission/tune-up 10% of the building space annually, and achieve 5% utility savings.

Re-Commissioning Tune-Up

Performance Indicators:

- Building square footage re-commissioned/tuned-up
 - 2016: 30% of total facility square footage
 - 2020: 70% of total facility square footage

Lead(s):

- DPW, Division of Property Management


Related Actions:

- DCM-1: Green Building in New Construction and Major Renovations
- DCM-3: Preventative Maintenance
- E-1: Energy Efficiency in Existing Buildings
- E-3: Building Automation Systems

Average Annual Near-Term (2013-2016)			Annual Savings in 2030	
Resource Savings (per yr)	Cost Savings (\$/yr)	Cost (\$/yr)	Resource Savings	Net Cost Savings (\$)
1,100 MWh 7,200 MCF 1,300 MTCO ₂ e	\$200,000	\$640,000	6,500 MWh 42,000 MCF 6,700 MTCO ₂ e	\$650,000

Next Steps (2013-2015)

1. Develop a re-commissioning program.
 - a. Pilot re-commissioning on two to five buildings, prioritizing those with an existing BAS.
 - b. Develop plan for re-commissioning remaining high priority City buildings (e.g. >50,000 sq ft).
 - c. Re-commission buildings every 5 to 10 years.

- 
2. Develop small building tune-up program.
 - a. Pilot tune-ups on three to five buildings that are less than 50,000 square feet, giving highest priority to buildings that have single zone rooftop units with economizers controlled by thermostats.
 - b. Develop plan for tune-ups of remaining City buildings where cost-effective savings can be achieved.
 3. Ensure Sustainable Building Policy requirement for commissioning of all new construction and major renovations is being met (see Action DCM-1).

E-5: Cleveland Division of Water System Pumping and Treatment Optimization

Action: Finalize and implement an Energy Management Plan to reduce energy consumption and costs for CWD.

The City of Cleveland Division of Water (CWD) is a regional water service provider to 1.5 million customers in 6 counties within the Lake Erie watershed. As a result of this large service area, CWD accounts for about 50% of the City’s total electricity consumption. In October 2011, CWD released a Draft Energy Management Plan establishing a framework for managing and reducing energy consumption and costs for CWD. This strategy outlines the general objectives of this plan; the Draft Energy Management Plan should be referenced for specific details and guidance.

Costs and Benefits

Costs for this strategy include, but may not be limited to, capital costs for infrastructure, equipment upgrades, software, etc.; service contracts for energy assessments, data management system development, etc.; and staff training. As referenced in the 2012 Five Year Capital Improvement Program, costs through 2014 for this strategy include \$500,000 for an energy database and \$2,000,000 for Energy Management Phase 2.

The benefits of this strategy include reduced CWD energy costs and a more comprehensive understanding and management of CWD operations. For actions such as improved pressure management, there would also likely be water savings from reduced losses in the distribution system.

Average Annual Near-Term (2013- 2016)			Annual Savings in 2030	
Resource Savings (per yr)	Cost Savings (\$/yr)	Cost (\$/yr)	Resource Savings	Net Cost Savings (\$)
21,000 MWh 18,000 MT CO _{2e}	\$1.8 million	\$830,000	38,000 MWh 26,000 MT CO _{2e}	\$3.3 million

Next Steps (2013-2015)

1. Share this analysis/plan with the CWD Energy Task Force and develop an approach for finalizing and implementing the CWD Energy Management Plan.
2. Utilize data available in EnergyCAP to establish a plan for monitoring and managing results.
3. Leverage U.S. Environmental Protection Agency (EPA) ENERGY STAR partnership and commitment to measure current energy performance, set goals, track savings, and reward improvements.
4. Purchase necessary software to automate pumping systems and optimize operations.
5. Review options for improved pressure management in the distribution system, where a higher safety factor for water shortages is balanced against energy and water savings. During a pilot test that began in June 2011, tank elevations were dropped by 6 feet and a 6% energy cost savings was realized with no impact to performance.

CWD System Pumping and Treatment Optimization

Performance Indicators:

- CWD electricity consumption, reduction from baseline
 - 2014: 10%
 - 2020: 15%
 - 2030: 20%
- kWh per Million MCF delivered, for each of the 9 pumping districts

Lead(s):

- CWD Energy Task Force

Related Actions:

- W-4: Cleveland Division of Water System Loss Minimization

E-6: Streetlight Upgrades

Action: Replace streetlights with LED lights, thereby saving the City money through reduced energy and maintenance costs.

The City has approximately 67,000 streetlights that cost about \$12 million per year to power. The cost to power and maintain these lights can be significantly reduced by using LED lights because they are more efficient and last longer than traditional streetlights. The City has already contracted with a number of vendors to purchase and test LED streetlights at two locations. The \$500,000 pilot project could involve as many as 340 streetlights supplied by up to 14 manufacturers. The equivalent of 150, 250 and 400 Watt fixtures will be tested. CPP expects installation to begin by first quarter 2013.

Costs and Benefits

Costs include fixture capital costs as well as any labor required for installation; however, any decreases in costs as a result of a standard spec and bulk orders are not addressed. Benefits of the strategy include electricity use reduction and cost, as well as a longer lifetime on lights, resulting in lower replacement/maintenance/disposal costs and improved security. The only cost savings presented here are the direct savings from reduced electricity consumption; reduced maintenance/disposal costs are not included.

Streetlight Upgrades

Performance Indicators:

- Percentage of streetlights replaced with LED fixtures
 - 2016: 5%
 - 2020: 10%
 - 2030: 50%

Lead(s):

- Cleveland Public Power

Related Actions:

None

Average Annual Near-Term (2013-2016)			Annual Savings in 2030	
Resource Savings (per yr)	Cost Savings (\$/yr)	Cost (\$/yr)	Resource Savings	Net Cost Savings (\$)
1,200 MWh 1,000 MTCO _{2e}	\$100,000	\$440,000	20,000 MWh 13,000 MTCO _{2e}	\$300,000

Next Steps (2013-2015)

1. Install pilot project lights.
2. Measure energy use/savings and evaluate effectiveness of pilot project.
3. Based on pilot, develop standard Cleveland streetlight specification. Update City costs based on more efficient lights.
4. Continue rolling out LED streetlights city-wide.

E-7: Renewable Energy

Action: Install a variety of renewable energy systems at City facilities and on City lands, including solar photovoltaic (PV), solar thermal (hot water), wind, and geothermal heat pumps.

For solar PV and solar thermal, the suitability for installation at City facilities was roughly evaluated using satellite photos of City roof tops. Solar thermal was specified for facilities with larger typical hot water demands including fire stations, police stations, and recreation centers (especially those with indoor pools). Solar PV was specified for suitable roof areas for the remaining City facilities. Ground-mounted solar PV installations on vacant or park land will have to be evaluated for adequate space, the presence of shading from surrounding trees and buildings, security concerns, etc.

Solar PV installations over parking lots are also opportunities, but not considered here because of typically higher costs of installation associated with parking canopies. However, appropriate applications can exist, such as the one currently being planned for Hopkins Airport.

For wind turbines, most of Cleveland is in a less than ideal wind regime for generating power (wind power class 1 or 2 at a height of 50 meters), particularly when the wind shear from buildings, trees and other obstructions is considered. Exceptions include off-shore sites in Lake Erie that are almost exclusively class 4 and above, and some class 3 sites near the shore. The City has some facilities on properties near Lake Erie that may be suitable for one or more turbines. A March 2012 study of wind potential at two sites (Garrett Morgan Water Treatment Plant and Jergens, a private company) commissioned by the City of Cleveland showed reasonable promise.

Based on a very preliminary review of satellite imagery, it appears there may be about 10 sites at City facilities worth additional consideration for traditional horizontal axis wind turbines. This action assumes that a total of six turbines are developed and distributed between these sites and that these turbines have a maximum of 60m hub heights for more likely compatibility with neighboring uses.

In addition to the installations at City facilities, City lands can be used for the installation of larger, utility-scale solar and wind pilot projects. As part of this plan, a 2MW solar array and 4MW wind farm are included in the analysis.

Costs and Benefits

Costs for solar PV and thermal are based on typical costs for installation by a third party. Costs for wind turbines are based on existing Ohio wind feasibility studies, including the March 2012 study. A premium is included for interconnection, inflation, and additional site study costs. Cost savings will depend on the financing and energy contract mechanisms but the estimates are based on current electricity and natural gas unit costs and projected future escalation of energy costs.

Renewable Energy

Performance Indicators:

- Total installed renewable energy production by technology type

Lead(s):

- Office of Sustainability
- DPU, DPC, and DPW

Related Actions:

- E-8: Cleveland Public Power's Advanced Energy Portfolio Standard
- DCM-1: Green Building in New Construction and Major Renovations

Given the relatively high up front capital required for solar PV and wind, a third party ownership scenario using a Power Purchase Agreement (PPA) is a logical option, where a third party sells power generated by the installations to the City. This allows the third party to take advantage of tax credits and accelerated depreciation for which the City would not be eligible. After the investor(s) has(ve) been reimbursed for the cost of the project, ownership of the equipment could flip to the City, allowing the City to benefit from the power produced and the sale of renewable energy credits for the remaining life of the equipment. For the right applications, solar thermal and geothermal heat pumps are generally more cost-effective and do not require third party ownership.

The utility scale solar and wind pilot projects are assumed to be implemented earlier in the planning horizon and a PPA would be used to finance these larger projects. With the PPA approach, the City would not be able to claim the renewable energy credits (GHG savings) or any cost savings for these projects until the end of the PPA contract (typically 10-20 years), but the City also would not incur any upfront cost for project installation. On the other hand, by postponing on-site renewable installations until later in the planning horizon (2016 and after), the City can use savings from other SC-MAP actions to pay for the installation of these projects so that the environmental and cost benefits can be realized from the time of installation. For the projected annual savings in 2030, this analysis also assumes a longer timeframe of 20 years for the PPA contracts for the utility scale projects, the pricing structure of which is considered to include associated costs of feasibility studies.

Average Annual Near-Term (2013-2016)			Annual Savings in 2030	
Resource Savings (per yr)	Cost Savings (\$/yr)	Cost (\$/yr)	Resource Savings	Net Cost Savings (\$)
430 MWh 92 MCF 360 MTCO ₂ e	\$56,000	\$490,000	19,000 MWh 5,800 MCF 13,000 MTCO ₂ e	(\$460,000)

Next Steps (2013-2015)

1. Conduct detailed solar feasibility studies at select buildings to evaluate suitability, performance, and costs. Solar thermal systems should be evaluated for fire and police stations, recreation centers and/or other facilities with large hot water demands.
2. Depending on the solar feasibility study results, issue Request for Proposals for renewable energy installations on select City properties (similar to a City of Cincinnati project for 2MW of renewable energy), to include financing approaches with little or no upfront capital required from the City. Databases of City facility roofs, such as the one operated by Tremco, can be provided as a resource. Otherwise, conduct costing study and identify funding sources as necessary.
3. Perform more detailed siting/feasibility studies for City properties with wind potential, such as Fire Station #5, Fire Station #40, the Fire Academy, Mounted Unit Stables, Glenville Streets and Waste, J Stamps Service Center, Collinwood Recreation Center, Cudell Recreation Center, E.J. Kovacic Recreation Center, and Kirtland Pumping Station.
4. Pursue implementation at suitable locations, including contracting with a third party through a Power Purchase Agreement, or direct purchase/ownership by the City.

E-8: Cleveland Public Power’s Advanced Energy Portfolio Standard

Action: Increase the amount of advanced and renewable energy in the electricity supply portfolio that serves City facilities.

In 2008, the City of Cleveland adopted a voluntary Advanced Energy Portfolio Standard (AEPS) that calls for 15% of CPP’s energy come from advanced or renewable sources by 2015, 20% by 2020, and 25% by 2025. To meet these voluntary goals, CPP is currently purchasing electricity from the Collinwood BioEnergy facility, which uses anaerobic digestion to produce electricity from organic waste. CPP has committed to purchase 5 MW of energy from the proposed pilot off-shore wind farm in Lake Erie as well as hydro power from regional sources.

Because CPP is a municipal utility, it is not subject to the requirements of Ohio’s Renewable Portfolio Standard (RPS) that took effect in 2008. However, the Cleveland Electric Illuminating Company (part of FirstEnergy) is subject to Ohio’s RPS, which requires the state’s four inventor-owned utilities to generate at least 12.5% of their electricity from renewable sources (e.g., wind, solar, landfill gas) by 2024 and 12.5% from advanced energy sources (e.g., clean coal, advanced nuclear, distributed combined heat and power) by 2025. Many of the City’s buildings receive electricity from CEI, amounting to approximately 40% of total electricity consumption.

The level of penetration is based on incremental implementation of the City’s AEPS and Ohio’s RPS as noted above. Renewable energy resources are assumed to be zero carbon.

Costs and Benefits

To meet the goals of the City’s voluntary AEPS, CPP may incur increased power supply costs, a portion of which may get passed on to customers. These increases in cost are captured in the utility cost escalation applied to all actions (i.e. estimated electricity rate increase of 0.2% per year). Since the state-level RPS is mandated and will occur regardless, it is assumed that there is no incremental cost to the City. Key benefits of this action are reduced GHG emissions because of a lower carbon electricity supply portfolio, as well as more stable energy prices. There is no related reduction in energy consumption.

Cleveland Public Power’s Advanced Energy Portfolio Standard

Performance Indicators:

- Percentage of electricity portfolio from renewable sources

Lead:

- CPP

Related Actions:

- E-7: On-Site Renewable Energy

Average Annual Near-Term (2013-2016)			Annual Savings in 2030	
Resource Savings (per yr)	Cost Savings (\$/yr)	Cost (\$/yr)	Resource Savings	Net Cost Savings (\$)
17,000 MT CO ₂ e	N/A	N/A	98,000 MT CO ₂ e	N/A

Next Steps (2013-2015)

1. Implement AEPS targets for City.
2. Track outcomes of the AEPS and RPS implementation to assure the performance of this action.
3. Confirm that renewable sources used to achieve reductions are zero carbon.

E-9: Smart Savings

Action: Maximize cost savings for the City by utilizing various strategies, including energy demand curtailment, utility bill analysis, rate negotiation, etc.

A variety of opportunities exist for the City to realize cost savings from actions that result in little or no resource savings. One option is energy demand curtailment – curtailing energy use during periods of peak system demand. An example is raising thermostat settings during hot summer days to reduce demand from building cooling systems. This can be accomplished by manually adjusting thermostats and building controls or using digital/electronic controls, including Building Automation Systems (BAS). As stated in Action E-3, a BAS provides centralized control and monitoring of buildings systems that affects electricity demand and use, heating, cooling, ventilation, motors, lighting, and other equipment.

Another option involves analyzing utility bills to identify any abnormal fees and evaluate rates the city is paying for electric, natural gas, water/sewer and other utilities. Conducting rate negotiations with utilities can help ensure the City is paying the lowest rates possible, thereby maximizing cost savings.

Costs and Benefits

Costs for this action include, but may not be limited to, capital costs for system controls, equipment upgrades, software, etc.; staff training and education; and staff time to perform utility bill analysis and rate negotiations. While no specific cost savings values can be assigned at this time, benefits include reduced energy costs and a more comprehensive understanding of the City’s energy use, building management, system controls and employee awareness.

Next Steps

1. Participate, if possible, in Demand Side Curtailment Management and Demand Response Programs. CWD is already participating and has earned approximately \$670,000 in PJM Demand Response Payments since June 2011 and has enabling legislation to continue its participation. Research if existing legislation can be used to expand the participation to general funds, or if an amendment or new legislation would be required.
2. Reduce energy spend by conducting rate negotiations with utilities. Implementation of EnergyCAP provides the opportunity for more detailed rate analyses.
3. Save money by continuing to terminate utility accounts found no longer in use.

Smart Savings

Performance Indicators:

- Cost Savings

Lead(s):

Office of Sustainability, DPU, DPW

Related Actions:

- E-1: Energy Efficiency in Existing Buildings
- E-2: Energy Conservation in Existing Buildings
- E-3: Building Automation Systems
- DCM-1: Green Building in New Construction and Major Renovations

SC-MAP FOCUS AREA 3: TRANSPORTATION

Why is Transportation Important?



This focus area considers opportunities for the City to reduce fuel consumption, vehicle emissions, and vehicle miles traveled (VMT) in its day-to-day vehicle fleet operations and employee commuting. Addressing transportation is crucial because of the opportunity to

save money on fuel costs, reduce emissions that contribute to asthma, improve air quality, reduce congestion, reduce the need for parking, and create a healthier Cleveland.

Reducing transportation-related carbon emissions can involve a wide range of strategies, including shortening the number and length of trips, reducing the carbon intensity of travel, and incentivizing the most efficient modes of travel. Many strategies can be implemented immediately, while others are longer-term, more incremental solutions, such as replacing vehicles as they reach their end of life.

TRANSPORTATION GOALS

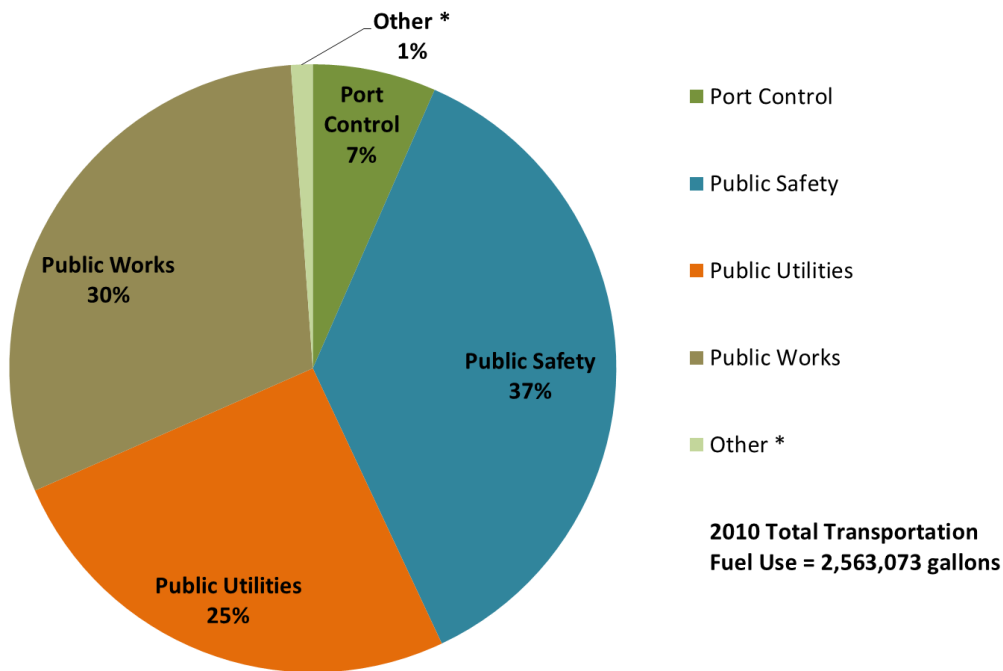
Goal 1: Reduced fleet fuel emissions

- 2016: 10%
- 2020: 15%
- 2030: 25%

Goal 2: Reduced commuter emissions

- 2016: 5%
- 2020: 10%
- 2030: 20%

Figure 7: Annual Fleet Fuel Use by City Department



** Other = Aging, Building and Housing, Community Development, Economic Development, Finance, General Government, Law, and Public Health*

Current Actions

In 2010, total fleet fuel use by City municipal operations was almost 2.6 million gallons (Figure7) the majority of which is split almost equally between the Public Safety, Public Utilities, and Public Works departments.

The City is already taking steps to address this focus area, including:

- A total of 62 hybrid vehicles, 15 compressed natural gas and 91 flex fuel vehicles in the fleet.
- CPP to install three electric vehicle charging stations.
- Passed an Anti-idling ordinance so no City vehicle or piece of equipment can be idled during non-emergency situations (2009).
- Passed a Complete and Green Streets ordinance requiring all construction and reconstruction in the right of way to incorporate best practices in complete streets and green infrastructure (2011); such practices include promoting alternative modes of transportation to accommodate pedestrians, cyclists, motorists and public transit.
- Passed a Bicycle transportation safety ordinance to help protect cyclists on the road (2012).
- Built the Bike Rack, a downtown facility featuring 50 bicycle storage facilities, showers and related amenities for commuters (opened in 2011).
- Over 30 miles of bike trails currently in the City, with a goal of reaching 180 miles.
- The City participates in the Regional Transit Authority's (RTAs) Commuter Advantage Program. The City also participates in Bike to Work Day each year.
- Solar powered trash and recycling system pilot project replaces convention trash bins with a new unit that compresses trash as it collects it and electronically alerts trash collectors through a web-based system when full, reducing the number of trash pick-ups required thereby reducing fuel consumption.

T-1: Green Employee Commuting

Action: Reduce employee commuting VMT through the increased use of tele-working and alternative transportation modes, such as the public transit system (RTA and downtown trolley system), carpooling (e.g., NOACA Ride Share Program), biking, and walking.

The City employs about 8,500 people, about 7,000 full-time, the vast majority of which commute by car to work each day. Based on a survey of City employees recently completed, 20% of commuters use alternative forms of transportation. About 7% commute by public transit, 3% by bike, 8% by walking, and 2% by some other mode of transport (**Figure 8**)

The City is already participating in the Regional Transit Authority's (RTAs) Commuter Advantage Program, with about 55 City employees currently using the program. The City also participates in Bike to Work Day each year.

Costs and Benefits

There should be minimal costs associated with marketing, education and awareness. Additional costs for individual elements of the action are as follows:

- **RTA passes** – Increase bus and rapid transit ridership by providing 25% discounts to employees. Passes through the Commuter Advantage program currently cost \$85 per month or \$1,020 annually. The discount could be paid from the General Fund, increased parking lot fees, or from the City employees, much like the current student U-Pass.
- **Biking** – Increase bicycle commuting by installing bike racks at City facilities, procured from the Metro Metal Works Bike Rack Program (partially funded through the City of Cleveland). Promote the new Bike Rack facility to employees. Costs for shower facilities are not estimated.
- **Carpooling** – Costs include marketing and any needed infrastructure for coordinating carpools.

Reduced Commuting Miles

Performance Indicators:

- Commuter VMT by mode of transportation (bus, carpool, bike, walk, tele-work, etc)

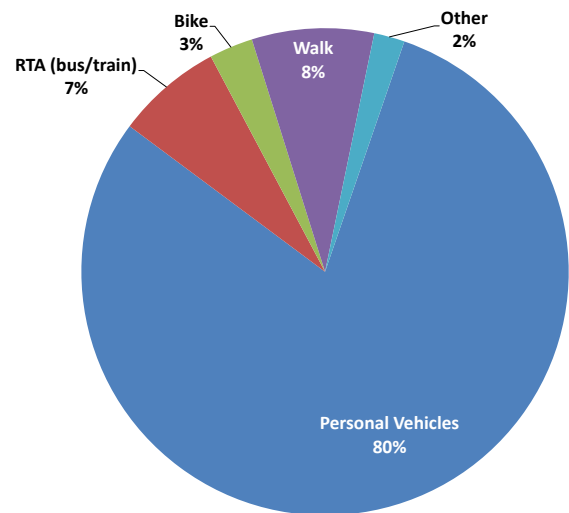
Lead:

Office of Sustainability

Related Actions:

- T-2: Green Fleet

Figure 8: Commuting Modes by City Employees



The benefits of using alternative transportation methods include potentially reduced need for parking, improved air quality, and reduced vehicle emissions that contribute to the City's GHG footprint. Other benefits include employee health and wellness, employee fuel cost savings, and more engaged and satisfied employees.

Average Annual Near-Term (2013- 2016)			Annual Savings in 2030	
Resource Savings (per yr)	Cost Savings (\$/yr)	Cost (\$/yr)	Resource Savings	Net Cost Savings (\$)
21,000 gal 180 MTCO _{2e}	N/A	\$50,000	130,000 gal 1,100 MTCO _{2e}	(\$310,000)

Next Steps (2013-2015)

1. Ensure sustainable transportation requirements in the City's Sustainable Building policy are met. The policy already addresses preferential parking for carpools and fuel-efficient vehicles, bike parking, and alternative fuel charging stations. Future versions of the policy should expand this to also consider things such as locating new facilities in areas served by transit.
2. Identify a funding source for subsidizing discounted bus passes and installing bike racks.
3. Identify locations for bike racks at City facilities.
4. Develop and implement a marketing plan for promoting bus passes, biking (including use of the Bike Rack), carpooling, tele-working, and the purchase of fuel-efficient vehicles.

T-2: Green Business Travel

Action: Reduce municipal fleet VMT both for regular vehicle routes and for occasional staff travel.

The City employs about 8,500 people, many of whom regularly use the approximately 7,000 City fleet vehicles to conduct their daily work and some who use fleet vehicles intermittently for work-related trips. This action involves using a variety of tools and technologies:

- Route optimization
- Video and tele-conferencing technologies
- Shuttle services and bus passes
- Ride sharing
- Bicycle infrastructure, including bike check-out program and additional racks

Costs and Benefits

The costs for this strategy include IT infrastructure City-wide, such as route optimization software and deployment, video conferencing technology and peripherals, and subsidized RTA passes. In addition, there will be costs associated with employee training to use the technologies and to encourage voluntary effort to use tools available to conduct City business while logging fewer miles on fleet vehicles.

Decreasing non-essential trips will save fuel and wear and tear on vehicles, while reducing vehicle emissions. In addition, reduced out-of-office travel time will increase employee productivity.

Average Annual Near-Term (2013-2016)			Annual Savings in 2030	
Resource Savings (per yr)	Cost Savings (\$/yr)	Cost (\$/yr)	Resource Savings	Net Cost Savings (\$)
84,000 gal 790 MTCO ₂ e	\$330,000	\$560,000	360,000 gal 3,400 MTCO ₂ e	\$1.4 million

Next Steps (2013-2015)

1. Develop a sustainable municipal transportation action plan that include tracking protocols, such as departmental VMT logs, service billing, etc., for tracking trips, as well as route optimization and automatic vehicle locator (AVL) technologies and a timeline for their implementation.
2. Evaluate Cleveland Water Division’s AVL program for outcomes and applicability across divisions.
3. Review need for additional video conferencing technology to create a robust teleconferencing infrastructure City-wide, including a web-based ride-sharing tool that will enable employees to take advantage of this option for meetings and City business travel.
4. Develop a pilot bike check out program and RTA pass subsidy for employees willing to use a bus or bike for work travel.

Green Business Travel

Performance Indicators:

- Percent reduction in total trip mileage
- Number of vehicles linked by route optimization systems
- Percentage of vehicles with AVL technology on board

Lead:

- All Divisions with service vehicles
- Information Technology & Services

Related Actions:

- T-1: Green Employee Commuting
- T-4: Anti-idling Enforcement

5. Determine feasibility of a bike share program in Cleveland, which City employees would be able to take advantage of.
6. Conduct review of current car sharing practices in Cleveland and within the City.
7. Determine the level at which existing alt fuel vehicles are using alt fuels.
8. Develop training and promotional materials to inform City employees about opportunities.

T-3: Vehicle Replacement and Repower

Action: Establish policy to ensure all new vehicle purchases and retrofits are more efficient conventional, hybrid, electric or alternative fuel vehicles, such as compressed natural gas (CNG).

This policy will build on existing successes to provide specific guidance by category of vehicle, such as maintenance trucks, safety vehicles, standard passenger cars, and others. The City has as an estimated fleet of 6,000 vehicles, of which 62 are hybrid vehicles, 15 use compressed natural gas and 91 are flex fuel vehicles.

Costs and Benefits

More efficient conventional, hybrid, electric vehicles, and alternative fuel vehicles can cost more up front, but have reduced operating costs and emissions over their lifetimes. The cost savings below assume 15,000 annual miles per vehicle. To achieve these savings, the City will purchase 20 efficient conventional vehicles and 10 hybrids per year starting in 2013 and 10 electric vehicles and charging stations per year starting in 2017.

- Approximate incremental cost premium for more efficient vehicles
 - Efficient conventional – \$1,000
 - Hybrid – \$5,000
 - EV – \$20,000 (expected to decrease by 2017)
 - Repower from diesel to CNG – \$13,000
- Benefits
 - Efficient conventional – Up to \$300 in annual fuel savings and combined fuel efficiencies of around 32 MPG.
 - Hybrid – Up to \$900 in annual fuel savings and combined fuel efficiencies of up to 50 MPG (60% higher than conventional vehicles).
 - EV – Up to \$1,300 in annual fuel savings (\$1,800 if charged off-peak) and equivalent fuel efficiencies of up to 95-100 MPG (34-37 kWh per 100 miles). Significant decrease in overall GHG emissions if they are charged at night or during baseload times and slight increase in emissions if charged in the daytime during peak times.
 - CNG repower – Significant decrease in GHG emissions and other air pollutants, as well as decreased cost.

Vehicle Replacement and Repower

Performance Indicators:

- Percent of vehicles that are fuel efficient, hybrids, CNG, or electric
- Combined fleet fuel efficiency

Lead(s):

- All Divisions with service vehicles (MVM, DPU, DPC, DPW, etc.)
- Purchasing and Supplies
- Office of Sustainability

Related Actions:

- T-2: Green Business Travel

Average Annual Near-Term (2013-2016)			Annual Savings in 2030	
Resource Savings (per yr)	Cost Savings (\$/yr)	Cost (\$/yr)	Resource Savings	Net Cost Savings (\$)
47,000 gal 190 MTCO ₂ e	\$99,000	\$270,000	340,000 gal 1,200 MTCO ₂ e	\$490,000

Next Steps (2013-2015)

1. Incorporate vehicle replacement into purchasing policy to be developed (see Action M-4).
2. Submit grant proposals to Ohio EPA (e.g. Diesel Emission Reduction Grants), especially for diesel vehicle repower/retrofits to CNG.
3. Further investigate currently available efficient conventional, hybrids, and EVs and determine which fleet vehicles they could replace based on ability to perform a similar function, and if the fleet should be right-sized.
4. Identify City buildings where EVs could be regularly used, and therefore require electric charging stations.
5. Investigate replacement options for non-passenger vehicles.

T-4: Anti-Idling Enforcement

Action: Enforce the City’s anti-idling policy using appropriate technology, education, and training.

According to the American Council for an Energy-Efficient Economy, a vehicle will burn more than half a gallon of fuel for every hour spent idling, and 10 seconds of idling uses more fuel than restarting the vehicle. Furthermore, running an engine at low speed (idling) causes twice the wear on internal parts compared to driving at regular speeds. The City’s no-idling policy (2006 and 2009) serves to protect public health and the environment by reducing emissions while conserving fuel and extending vehicle lifetimes.

Costs and Benefits

There should be minimal costs associated with anti-idling education and awareness. Costs to retrofit existing vehicles with anti-idling technologies and to purchase new vehicles with these technologies are higher, at \$200 to \$500 per vehicle. The benefits of the action include reduced fuel costs, longer vehicle lifetimes, and fewer emissions. On the basis of a study conducted to assess the anti-idling vehicle ordinance in Minneapolis, fuel savings of up to 15% can be achieved through compliance with anti-idling policies. For example, if the City of Cleveland were to install anti-idling technology on 25% of its fleet, it could potentially save more than 65,000 gallons of fuel and \$250,000 annually, depending on the types of vehicles and the length of idle time allowed.

Anti-Idling Enforcement

Performance Indicators:

- Anti-idling timers/devices installed on fleet vehicles (#)
- Annual policy infractions (#)

Lead(s):

- Department of Public Works and other divisions with service vehicles
- Division of Motor Vehicle Maintenance
- Information Technology & Services

Related Actions:

- T-2: Green Business Travel
- T-3: Vehicle Replacement and Repower

Average Annual Near-Term (2013-2016)			Annual Savings in 2030	
Resource Savings (per yr)	Cost Savings (\$/yr)	Cost (\$/yr)	Resource Savings	Net Cost Savings (\$)
61,000 gal 590 MTCO ₂ e	\$240,000	\$220,000	170,000 gal 1,700 MTCO ₂ e	\$780,000

Next Steps (2013-2015)

1. Conduct an analysis of City fleet vehicles to determine which, if any, could benefit from the installation of anti-idling technology, building off the success of the GPS trackers installed on CWD vehicles.
2. Educate department leadership on the existing anti-idling policy and provide tools for enforcement, such as anti-idling controls in vehicles, dashboard signs, training to monitor and issue citations for violations, etc.
3. Provide anti-idling training to all employees who drive City vehicles that includes effective messaging and allays myths about vehicle idling. Incorporate into Sustainability 101 training.
4. Incorporate compliance with the anti-idling policy into SMART objectives for employees who operate fleet vehicles regularly.
5. Track calls to 311 and Mayor’s Action Center hotline where community members report long-term idling.

SC-MAP FOCUS AREA 4: WATER

Why is Water Important?



Water is a precious resource that should be used efficiently, both indoors and outdoors, and for which quality should be protected. In 2011, the City of Cleveland's municipal operations had over

68,000 MCF (or 396 million gallons) of metered water consumption (1 MCF = 1,000 cubic feet or 7,480 gallons of water). Water efficiency and conservation applies to irrigation practices, landscape maintenance, end-use water fixtures, and indoor process water use. Because the City does not currently pay for water, efficiency and conservation actions will not directly save water utility costs, but energy cost savings will be realized by reducing hot water consumption and the need for water pumping. Managing stormwater improves water quality by placing less demand on Northeast Ohio's municipal sewer/stormwater infrastructure, while also beautifying Cleveland's neighborhoods with green infrastructure. This section focuses on steps the City will take to reduce indoor and outdoor water use at City facilities and reduce stormwater runoff from City-owned land.

Current Actions

In 2010, total metered water use by City municipal operations was over 68,000 MCF (**Figure**) with two-thirds coming from the Public Works department.

The City is already taking steps to address this focus area, including:

- Implementation of the Plant Enhancement Program to restore CWD's four water-treatment plants. For example, Kirtland Pump Station retrofitted four raw water pumps, renovated a raw water pump building exterior, and constructed a LEED Silver certified Specialty Maintenance Building.
- The Division of Parks installed three permeable pavement and paver parking lots at Morgana, Kennedy and Impett Parks (2009 and 2010).
- The Division of Water has initiated an Automatic Meter Reading (AMR) program, to be fully rolled out by 2014.
- Stormwater management showcase at Water Pollution Control's Kirby Road facility.

WATER GOALS

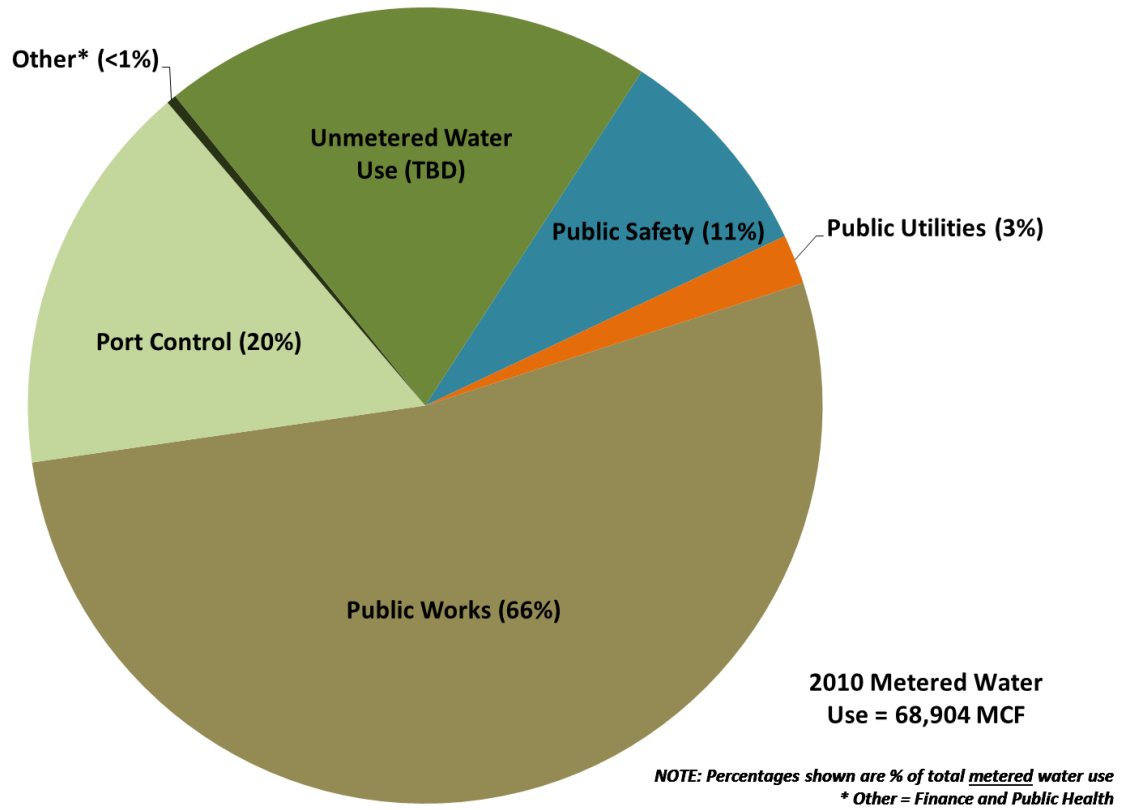
Goal 1: Total water use reduction below 2010 baseline

- 2016: 10%
- 2020: 20%
- 2030: 50%
(current SC-MAP actions achieve 30%)

Goal 2: Impervious area runoff captured:

- 2016: 80,000 sq ft
- 2020: 240,000 sq ft
- 2030: 840,000 sq ft

Figure 9: Annual Metered Water Use by City Department



W-1: Water Efficiency

Action: Improve water efficiency through assessments and upgrades in City facilities.

As part of the Cleveland 2030 District, the City of Cleveland has a goal of reducing water use in its existing buildings 50% by 2030. This action focuses on opportunities for water efficiency improvements in existing buildings to help the City meet this goal. Typical water efficiency upgrades include, but are not limited to, low flow sinks and toilets (with automated sensors), WaterSense equipment (dishwashers, clothes washers, etc.), and improved irrigation controls.

Costs and Benefits

Costs include facility assessments to identify savings opportunities as well as the purchase of equipment and fixtures identified through the water assessment process. For the purposes of this analysis, project costs were estimated assuming an average 5 year payback for water efficiency projects. One challenge is that many City buildings do not currently pay for water. After building assessments are completed and specific water efficiency projects are identified, this cost estimate can be refined.

Depending on the age of the building and related water use fixtures and equipment, efficiency upgrades can typically save 5-10% on water use and utility costs with the opportunity for additional incremental savings in future years as more water efficient technology comes to market. Additionally, energy savings can be realized due to reduced hot water use as well as reduced water delivery/distribution needs.

To estimate the potential savings and related costs through the 2030 planning horizon, it was assumed that approximately 5 percent of City building space would be upgraded annually through 2016 (10 percent annually thereafter) and an average 10 percent savings could be realized for each building. For each round of upgrades, a one-time implementation cost was estimated assuming an average 5 year payback for efficiency projects.

Average Annual Near-Term (2013-2016)			Annual Savings in 2030	
Resource Savings (per yr)	Cost Savings (\$/yr)	Cost (\$/yr)	Resource Savings	Net Cost Savings (\$)
290 MCF 5 MT CO ₂ e	n/a	\$25,000	5,400 MCF 70 MT CO ₂ e	(\$51,000)

Water Efficiency

Performance Indicators:

- Facility Assessments and efficiency upgrades (%)
 - 2016: 10% of City facility square footage assessed and upgraded
 - 2020: 20% of City facility square footage assessed and upgraded
 - 2030: 100% of City facility square footage assessed and upgraded

Lead(s):

- DPW, Division of Property Management
- DPW, Division of Parks and Recreation
- DPU, DPC

Related Actions:

- E-1: Energy Efficiency in Existing Buildings
- DCM-1: Green Building for New Construction and Major Renovations
- DCM-3: Preventive Maintenance

Next Steps (2013-2015)

1. Develop a system to track progress by cataloging facility assessments, water efficiency projects implemented, planned projects, etc. This can possibly be done in ENERGY STAR Portfolio Manager along with energy projects.
2. Ensure compliance with Sustainable Building Policy that requires water efficiency standards for retrofits, renovations, and new construction (see Action DCM-1)
3. Prioritize all City buildings for efficiency upgrades based on the following criteria:
 - Water use intensity (for facilities that are currently metered)
 - Projected water savings potential
 - Visibility
 - Contraction analysis
4. Conduct water assessments for highest priority facilities and implement identified savings
5. Work with Division of Water to actively track water consumption once AMR is fully implemented at City facilities in 2014.
6. For buildings that do not currently pay for water use, identify additional strategies to incentivize water efficiency and conservation. As an example, many efficiency and conservation measures will reduce hot water demand and related energy consumption and costs which can help to incentivize implementation (estimated energy savings have not been included in the analysis presented here).
7. Evaluate options for instituting a structure that requires City facilities to pay for at least a percentage of the water services provided. The City's AMR consultants report that when cities go from unmetered water to metered use, consumption immediately drops 15-25%.

W-2: Water Conservation

Action: Reduce water use through a variety of water conservation measures.

Where water efficiency focuses on equipment upgrades, water conservation targets opportunities for reducing water end-use by employees through education campaigns, incentive programs, availability of data for decision making, etc. In conjunction with Action E-3, this strategy also addresses the additional water savings that can be achieved through more robust data monitoring and management.

Costs and Benefits

Costs include administrative costs to develop educational/training materials (webinars, signage, etc.), incentive programs, and competitions, which can be developed in conjunction with Action E-2. A cost of \$0.10 per square foot has also been assumed for adding water to Action E-3 plus an additional \$5,000 for each park or pool.

The majority of water conservation savings is realized through the implementation of a building automation system and the ability to more closely monitor and manage water use. This allows potential leaks to be more easily identified. Water conservation efforts, including the BAS, and employee education are likely to realize a combined 10-15% savings in water use and utility costs. As with water efficiency, energy savings can be realized, in addition to water savings, due to reduced hot water use and water delivery/distribution needs.

Water Conservation

Performance Indicators:

- Building square feet controlled by BAS
- Employees trained in sustainability and water conservation practices
- Building dashboards installed that include water use
- Sustainability champions assigned at each major building

Lead(s):

- Office of Sustainability
- DPW, Division of Property Management


Related Actions:

- E-2: Energy Conservation
- E-3: Building Automation Systems
- DCM-1: Green Building in New Construction and Major Renovations
- DCM-3: Preventive Maintenance

Average Annual Near-Term (2013-2016)			Annual Savings in 2030	
Resource Savings (per yr)	Cost Savings (\$/yr)	Cost (\$/yr)	Resource Savings	Net Cost Savings (\$)
1,500 MCF 23 MT CO ₂ e	n/a	\$51,000	5,700 MCF 70 MT CO ₂ e	(\$14,000)

Next Steps (2013-2015) – In conjunction with Action E-2

1. Develop and rollout a water conservation campaign to educate City employees about conservation opportunities and encourage participation.
2. Install technology to visually display real-time building energy (and water) use, similar to a building dashboard. As a Cleveland 2030 District member, the City may have access to a web-based building dashboard to be developed by a third party consultant.
3. Hold quarterly Sustainability 101 trainings available to all City employees. Explore the possibility of making a one-hour Sustainability 101 training mandatory for all City employees.

- 
4. Consider holding a Water Office Challenge, or other incentive programs, to encourage conservation across all City departments.
 5. Utilize City Green Team as ambassadors for each department to educate employees on water conservation measures. Green Team to identify Sustainability Champions at each major building.

W-3: Water Reuse and Recycling

Action: Use captured rainwater to supply irrigation and cooling tower water use.

Due to the configuration of the water supply system there are many building water uses supplied with potable water that do not require this level of treatment. This leads to unnecessary treatment costs (energy, chemicals, etc). Examples include irrigation, cooling tower, and vehicle washing water use.

Costs and Benefits

Costs include equipment, infrastructure, and maintenance of rainwater harvesting systems. The benefits include reduced water service costs for City departments. Reducing water consumption also contributes to reduced energy consumption, and associated greenhouse gas emissions and chemical use. Rainwater harvesting will also reduce the stormwater fees incurred by the City due to the reduction in impervious area/runoff (this savings is not included in the analysis presented below but is considered in the cost-benefit analysis for Action W-5).

Low water costs in Cleveland, required capital and O&M costs, and largely unquantifiable benefits results in rainwater harvesting typically not penciling out from a cost-benefit perspective. However, the City can use this action as an opportunity for demonstration projects and to lead by example.

Water Reuse and Recycling

Performance Indicators:

- Percent of City roof area with rainwater harvesting (%)
 - 2016: 5%
 - 2020: 10%
 - 2030: 25%

Lead(s):

- DPW, Property Management
- Water Pollution Control with Northeast Ohio Regional Sewer District

Related Actions:

- W-5: On-Site Stormwater Management
- DCM-1: Green Building for New Construction and Major Renovations
- DCM-3: Preventive Maintenance

Average Annual Near-Term (2013-2016)			Annual Savings in 2030	
Resource Savings (per yr)	Cost Savings (\$/yr)	Cost (\$/yr)	Resource Savings	Net Cost Savings (\$)
6 MCF	n/a	\$210,000	0 MCF 1 MT CO ₂ e	(\$250,000)

¹ Due to the limited amount of water consumption data available for City facilities, the numbers presented here are rough estimates based on average precipitation and the assumption that there would be sufficient demand for the captured water. Before this action is implemented, additional analysis should be conducted to optimize the storage capacity based on runoff and demand at each facility.

² All costs for this action assume a 50% match from grant funding.

Next Steps (2013-2015)

1. Identify top priority facilities for rainwater capture based on the following criteria
 - Non-potable water demand (irrigation, cooling tower, vehicle washing, etc)
 - Adequate rooftop area and appropriate configuration for rainwater capture
 - Location where a staff person is available to oversee and maintain the system
2. Conduct more detailed modeling/analysis to optimize storage based on demand and rainfall
3. Ensure Sustainable Building Policy requirements for rainwater harvesting are met (see action DCM-1)

W-4: Cleveland Division of Water System Loss Minimization and Meter Installation

Action: Significantly reduce water distribution system losses to save water, reduce energy and other costs associated with water delivery, and improve the health of Lake Erie.

Throughout the CWD system, it is estimated that 40% of all water is considered non-revenue water (leaks, unmetered use, etc.), which is significantly higher than the typical 10% to 15% for newer large water systems, and 25-30% for older systems. Non-revenue water is calculated as the difference between water pumped and water billed by CWD. The automatic meter reading (AMR) rollout initiative, which will be complete in 2014, will help to refine this estimate and quantify the extent of leaks in the CWD system.

With regard to the water used directly by the City for municipal operations, only a limited number of buildings are charged for water use, and some are not metered at all. This has contributed to limited water use monitoring and awareness at City facilities.

Costs and Benefits

This action would require significant infrastructure costs to repair leaks throughout the CWD distribution system. Benefits would include water, energy, and chemical savings due to the reduction in water losses, along with the related cost savings to CWD. For the purpose of this analysis, it has been assumed that 80% of the losses are the result of system leaks and, if addressed, would save water as well as reduce costs from pumping water and chemical treatment. The other 20% of losses are attributed to unmetered use (including slow meters that under-register water use; approximately 3% of total water deliveries) and lost revenue to CWD, but there would be no resource savings for addressing these losses.

CWD is currently in the process of installing an automatic meter reading system for all water meters in the City, including municipal facilities. Funds have already been allocated for this project and roll-out will be complete in 2014. CWD will also incur additional costs to address any physical leaks in the distribution system. For the City's direct water service that is currently un-metered, the major cost of this action (considering the meter installations are already allocated) would be the added cost to each City department whose water use is not currently metered. In addition to installing water meters, charging for water service (many City departments are currently metered but are not charged for water use) will provide a financial benefit to CWD as it will be able to secure payment for the delivery of these services. Charging for use would also likely reduce water use at City facilities as departments would be more aware of the water that is being consumed.

Cleveland Division of Water System Loss Minimization and Meter Installation

Performance Indicators:

- Percent of CWD distribution losses addressed
 - 2016: 1%
 - 2020: 5%
 - 2030: 10%

Lead:

- Division of Water

Related Actions:

- E-5: Cleveland Division of Water System Pumping and Treatment Optimization
- DCM-2: Capital Improvement Project Sustainability Review
- W-1: Water Efficiency
- W-2: Water Conservation

Average Annual Near-Term (2013-2016)			Annual Savings in 2030	
Resource Savings (per yr)	Cost Savings (\$/yr)	Cost (\$/yr)	Resource Savings	Net Cost Savings (\$)
260 Mgal 630 MWh 540 MT CO ₂ e	N/A	TBD	2,600 Mgal 6,300 MWh 4,300 MT CO ₂ e	TBD

1 The water savings would be for the entire CWD system. Savings at City facilities are not quantified directly but would be included in the approximate annual savings of \$1.5M.

2 Costs for this action will determined after an assessment of the system losses and required projects to address system leaks are identified.

Next Steps (2013-2015)

1. Division of Water to ensure that all City facilities are metered in 2014. Provide list of unmetered facilities to Division of Water to expedite this process.
2. Develop a prioritized list of projects based on level of impact, potential savings, etc., using Strategy DCM-2 for guidance.

W-5: On-Site Stormwater Management

Action: Improve stormwater management on City property to take advantage of credits offered by the Northeast Ohio Regional Sewer District (NEORS), at applicable (Enterprise Fund) sites.

The City’s Division of Water Pollution Control maintains the sewer system within the City, and delivers sewer water to NEORS for treatment. As part of its Regional Stormwater Management Program, the Sewer District began collecting stormwater fees in 2013 based on the impervious area on a site. To help manage the impact of this new fee and reduce stormwater runoff from City facilities, this action addresses opportunities to improve on-site stormwater management.

Costs and Benefits

Costs include the installation and operation and maintenance of stormwater management infrastructure. To minimize costs, this analysis assumes that upgrades to reduce imperviousness would only occur during replacement and/or retrofit of existing infrastructure.

The benefits of this action include reduced stormwater fees due to decreased impervious area as well as the improved water quality. Other green infrastructure options, such as green roofs, will also slightly reduce energy costs for buildings (reduce heating and cooling requirements). Stormwater management and green infrastructure also ease the effects of the urban heat island effect, reintroduce native bird species through smarter landscapes, and reduce the stress put on water treatment facilities receiving stormwater.

As shown below, on-site stormwater management typically does not pencil out from a cost-benefit perspective, even though the whole region benefits. However, the City can use this action as an opportunity for demonstration projects and to lead by example.

Average Annual Near-Term (2013-2016)			Annual Savings in 2030	
Resource Savings (per yr)	Cost Savings (\$/yr)	Cost (\$/yr)	Resource Savings	Net Cost Savings (\$)
n/a	\$1,000	\$12,000	n/a	(\$190,000)

Next Steps (2013-2015)

1. Ensure stormwater management requirements in the City’s Sustainable Building Policy are met.
2. Convene the Riparian Ordinance working group to identify the next round of demonstration projects at City facilities. Demonstration projects should focus on Enterprise Fund City facilities as all General Fund departments will not incur the stormwater fee from NEORS and therefore will not see a cost savings as a result of on-site management.

On-Site Stormwater Management

Performance Indicators:

- Total reduction in impervious area at City facilities:
 - 2016: 20,000 square feet
 - 2020: 40,000 square feet
 - 2030: 60,000 square feet
- Credits earned against NEORS stormwater fee (\$)

Lead:

- Water Pollution Control
- City Stormwater Management Working Group

Related Actions:

- DCM-1: Green Building for New Construction and Major Renovations
- W-3: Water Re-Use and Recycling

3. Continue to identify grants and other sources of funding for green infrastructure.
4. Incorporate City land into the Tree Canopy Assessment likely to be developed in 2013 for Cuyahoga County. Strategies for increasing tree canopy across the city will be addressed in more detail in the citywide Climate Action Plan.
5. DPC to finalize its Stormwater Management Plan in relation to post-construction best management practices (PCBMPs) for the water quality and quantity being discharged from airport construction sites. Four have been constructed to date including the Central Detention Basin, the North Detention Basin, bioretention cells at Riveredge Parking Lot, and an underground detention system with sand filter.

SC-MAP FOCUS AREA 5: MATERIALS MANAGEMENT AND PURCHASING

Why is Materials Management and Purchasing Important?



By world standards, waste in the United States is a large and growing problem. Major facilities and tracts of land are required to accommodate generated waste, and monitoring and mitigation are needed long after disposal. Actions that promote diversion of solid waste from landfills, such as recycling, can

reduce GHG emissions, prolong the life of landfills, and reduce City disposal costs. Recent data from the U.S. Environmental Protection Agency indicates that nearly 30% of carbon emissions associated with purchased goods can be attributed to the “life cycle” of these goods. These emissions occur at multiple stages of a product’s life cycle, from extraction and processing of raw materials to manufacture, distribution, storage and disposal. Therefore, environmentally preferable purchasing and reducing the use and amount of purchased goods from the start is crucial. It not only saves money, but also helps reduce the resource consumption and GHG emissions associated with products.

Current Actions

The City is already taking steps to address this focus area, including:

- Printing and Reproduction Sustainable Green Printing (SGP) certification, the first municipal print shop in the country to achieve this level of performance
- Printing and Reproduction maintains a City-wide cost-per-copy copier /printer program with duplex, eco-print standards and a toner recycling program
- Recycling promoted at many City facilities
- Printing and Reproduction is responsible for a City wide office paper contract that meets the federal standard of 30% recycled content and offers the option of 100% recycled content on request
- Purchasing department and others, such as CPP, trending towards more electronic file sharing
- West Side Market composting

MATERIALS MANAGEMENT AND PURCHASING GOALS

Goal 1:

Reduced annual gross/net operational solid waste per employee (baseline TBD)

- 2016: 5%
- 2020: 10%
- 2030: 20%

Goal 2:

Waste diversion rate (baseline TBD)

- 2016: TBD
- 2020: TBD
- 2030: 90% diversion for all City operations (certified zero waste)

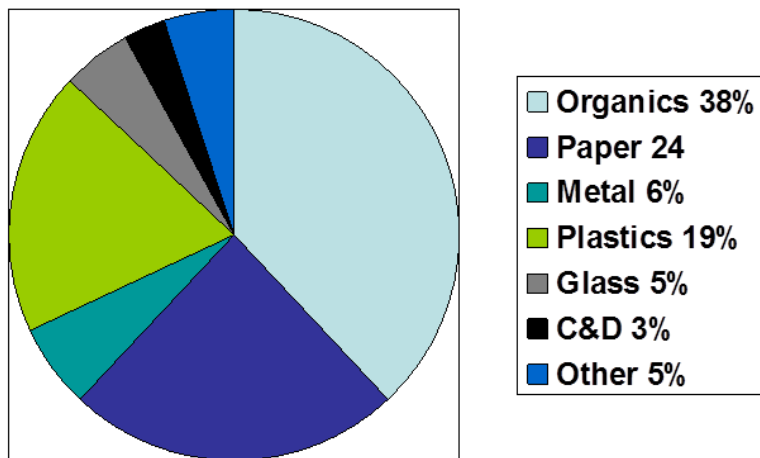
Goal 3:

Percent by cost of all purchases for goods that include sustainability aspects

- 2016: 25%
- 2020: 50%
- 2030: 75%

In addition, the City has performed preliminary analysis of its solid waste stream that goes to the Ridge Road Transfer Station (summarized in Figure 10 below). Approximately 62% of the waste stream is renewable carbon-based organics (i.e. paper, food waste, and yard waste), which are materials that are grown and not mined. About 30% of the Waste Stream is mined, non-renewable materials such as glass, plastic and metals (**Figure**). These data can serve as a valuable baseline for the City to implement Actions M-1 through M-4 summarized in this Focus Area.

Figure 10: City of Cleveland Waste Streams



M-1: Overall Waste Reduction

Action: Reduce waste generated in City facilities.

The City has not historically tracked its total waste volume or recycling rate at City facilities, but it is likely that the large majority of materials end up at local landfills.

While reducing the amount of solid waste generated per employee requires some necessary technology (e.g. printers with duplex capabilities), the bulk of gains will come from changes in employee behavior and the refinement of policies and processes.

Costs and Benefits

Additional upfront costs for this action are minimal. Costs include those for developing purchasing procedures for reduced packaging and just-in-time ordering; continuing to utilize the City wide cost-per-copy copier /printer program that hosts network printers and Multi-Functional-Products with environmentally friendly features (ENERGY STAR efficient, duplexing, eco-print, toner recycling and end-of-life take back); developing a materials exchange and re-use program; and offering training to make employees aware of waste reduction strategies and options, a key topic in Sustainability 101 training. The benefits of waste reduction include reduced hauling and landfill costs, reduced purchasing costs, and more accessible information systems.

Next Steps (2013-2015)

1. Develop tracking techniques to measure solid waste, recycling, and compost volumes annually.
2. Set targets for overall waste reduction as well as recycling and compost diversion rates based on data collected. Incorporate lessons learned and best practices from Cleveland Airports and other departments. Printing and Reproduction currently has a goal for paper use reductions.
3. Identify opportunities in purchasing procedures to incentivize/require bidders to reduce packaging.
4. Conduct waste audits and champion waste reduction efforts. Educate employees on waste reduction, including signage that reminds employees to reduce waste.
5. Purchasing and other departments to identify opportunities for more electronic data sharing.
6. Identify and implement paperless technologies and processes to eliminate waste in all areas. For Purchasing, the goal is to make the final contract the only piece of required printing.
7. Consider intra-departmental reuse and exchange website for posting excess materials.
8. Establish policy setting all printer default settings to duplex printing.
9. Printing and Reproduction, working with the City's IT Divisions (Finance, Safety, Port Control, etc.), can analyze printing levels from each computer to identify offices that require training.
10. Printing will conduct print assessments with mapping to help remove obsolete printers that are not under contract and move individuals away from desktop printers and towards Multi-Functional-Products and/or network printers.

Overall Waste Reduction

Performance Indicators:

- Annual gross/net operational solid waste per employee
- Annual volume of paper/supplies purchased
- Cost savings from reduced hauling and tipping fees

Lead(s):

- Information Technology & Services
- Purchasing & Supplies
- Printing & Reproduction
- Divisions of Waste Collection

Related Actions:

- M-2: Increased Recycling in City Buildings
- M-3: Compost Program for City Buildings

M-2: Increased Recycling in City Buildings

Action: Create a more robust recycling program to increase the rate of recyclable waste diverted from the landfill.

As with total waste volume, although the City has not historically tracked its recycling rate at City facilities, there is a lot of room for improvement. In order for the City to lead by example in sustainability, it must lead in recycling.

Costs and Benefits

There will be additional pickup costs associated with increased recycling; however, these may be offset by the benefits of diverting materials from area landfills. There will also be costs for additional bins, signage, and employee education, but these should be minimal and could be part of regular facilities maintenance and Sustainability 101 employee training.

The benefits of increased recycling include greater diversion rates from landfills and longer landfill lifetimes, reduced GHG emissions, increased job opportunities for recycling haulers and processors within the community, and the positive impact of leading by example. For example, in 2010 the City of Cleveland paid about \$9 million (between \$4 and \$5 per ton in landfill tipping fees (community-wide) and it is estimated that over 40% of this landfill volume could have been recycled. Over time, a well-run recycling program becomes innate and costs less to operate than waste collection and landfilling.

Next Steps (2013-2015)

1. Develop tracking techniques to measure solid waste and recycling volumes in order to monitor progress and develop goals for municipal recycling efforts (see Action M-1).
2. Develop education and training materials, and include recycling as a key topic covered in Sustainability 101 to engage employees and increase participation.
3. Establish a City-wide recycling program that includes the following:
 - a. Consistent signage and collection containers for all City departments, and in all City buildings
 - b. Differentiated waste and recycling bag colors for easier recognition
 - c. Contests/competitions among departments or buildings for highest level of diversion
 - d. Published cost savings relative to lower landfill tipping fees
4. Identify priority facilities for greater engagement, such as Hopkins Airport, where a greater amount of waste is generated per square foot.
5. Revise food service contracts to eliminate single-service containers and include recyclable or compostable service-ware.

Increased Recycling in City Buildings

Performance Indicators:

- Recycling diversion rate

Lead(s):

- Mayor's Office of Sustainability
- Divisions of Waste Collection and Property Management

Related Actions:

- M-1: Overall Waste Reduction
- M-3: Compost Program for City Buildings

M-3: Compost Program for City Buildings

Action: Compost organic waste from City facilities to reduce waste sent to the landfill.

In tandem with actions to reduce waste and increase recycling at City buildings, this strategy leverages the opportunity to engage and educate employees. Not only do organics, including food waste, account for approximately 38% of Cleveland's waste that ends up in landfills, it is typically heavy with moisture and removing it from the waste stream can reduce tipping fees that are paid per ton of waste.

This strategy can be built off the City's pilot composting effort at West Side Market, where organic material from vendors and customers is collected in closed bins and sent to Rosby's Resource Recycling to be added to the composting facility there. The resulting product is used for soil amendment.

Costs and Benefits

For composting at West Side Market, the City pays a tipping fee to Rosby that is equal to its landfill tipping fee. If this same model were used for composting in all City facilities, this action would be cost neutral. Though a direct cost savings wouldn't be realized, benefits for this action could include increased diversion rates and reduction in methane production in local landfills. In addition, it could provide revenue as a marketable commodity.

The Sustainable Cities Institute reports that according to the US EPA, the cost of municipal composting ranges from \$11 to \$102 per ton, and the avoided landfill disposal fees ranged between \$5 and \$137 per ton. Even though there will be initial start-up costs associated with closed bins, education, and transportation, these costs can be offset to some degree because wastes accepted at composting facilities are exempt from state disposal fees.

Next Steps (2013-2015)

1. Pilot composting at one or two City buildings to determine actual costs for closed bins, and transportation to composting sites, employee education, and any necessary composting infrastructure.
2. Work with food services contractors at these buildings to provide compostable service-ware that can be added to the compost bins.
3. Measure progress through vendor contracts (volumes of service ware) and diversion rates of compostable materials from City buildings.

Compost Program for City Buildings

Performance Indicators:

- Composting participation rate
- Composting diversion rates

Lead(s):

- Mayor's Office of Sustainability
- Divisions of Waste Collection, Property Management, Parks and Recreation

Related Actions:

- M-1: Overall Waste Reduction
- M-2: Increased Recycling in City Buildings

M-4: Sustainable Purchasing

Action: Develop and implement a comprehensive sustainable purchasing policy across City operations.

Sustainable or Environmentally Preferable Purchasing (EPP) not only reduces the City's GHG emissions, but also saves the City money, whether it is in purchasing, for example, products that are rechargeable or refillable, or fleet vehicles that are more fuel efficient.

Areas typically included in a sustainable purchasing policy include:

- Source reduction
- Recycled content products
- Energy efficient and water saving products (already in Sustainable Building Policy)
- Landscaping
- Toxics and Pollution Prevention products
- Bio-based and forest protection products

In general, best practices in sustainability for procurement include purchasing products that reduce their environmental and/or social impact because of the way they are made, transported, stored, packed, used, and disposed.

In addition to providing guidelines for incorporating sustainability in product purchases, the City's Policy could also include guidance and a process to justify the need for new purchases in the first place.

Costs and Benefits

There would be administrative costs associated with the development and maintenance of a sustainable purchasing policy. Based on research of national models, the potential cost savings from green product procurement can range from minimal (less than 1%) to upwards of 10% (remanufactured cartridges, for example), depending on the practices implemented. In addition, using green products will contribute to better indoor air quality, resulting in healthier and more productive occupants.

Next Steps (2013-2015)

1. Update Local and Sustainable bid discount, and market to a wider audience of vendors that meet the requirements. The City currently receives 10-12 bids/year that take advantage of the local purchasing bid discount.
2. Update janitorial cleaning supplies specs to incorporate green cleaning.

Sustainable Purchasing

Performance Indicators:

- Percent by cost of all purchases for goods that include sustainability aspects
- Percent of purchases of energy-using products that are ENERGY STAR products
- Per staff dollar value of all new goods purchased (vs. re-used, re-purposed, or replaced by other used goods)
- Metrics for specific products (e.g., percent of paper consumed with 100% recycled content, percent of electronics equipment certified to a certain EPEAT level, etc.)

Lead(s):

- Purchases and Supplies
- Office of Sustainability

Related Actions:

- M-1: Overall Waste Reduction

3. Develop and adopt a Sustainable Purchasing Policy, which will require an ordinance. Explore topic areas beyond traditional sustainable purchasing, such as sourcing of food and other goods locally where feasible, reducing purchases of bottled water, and integrating other certified product purchases such as Fair Trade Certified.
4. Develop a brief guide for departments and employees that provides guidelines for when to purchase new goods versus re-purposing or re-using goods. Consider implementing a cross-departmental materials exchange program for office supplies and other goods.
5. Develop a decision tool, including guidelines and criteria, for selecting green products and incorporate these guidelines into the procurement process. Connect the developed decision tool with an associated tracking/accountability method for determining progress.
6. Incorporate sustainability boiler plate language into 'Instructions to Bidders' and 'General Requirements'.

IMPLEMENTING THE SC-MAP

Organizational Assessment and Alignment



An important part of implementing the SC-MAP is linking its actions with the City's existing activities and organizational structure. Key cross-cutting factors include how the City is governed and organized, human resources management, budgeting and financial management, communications, and core values. In some cases, re-organization of departments and processes may help increase efficiencies. With approximately 8,500 employees, the City is a complex enterprise with a set of policies, plans, procedures and workplace tools crossing these various systems. Some steps that can be taken to help implement and sustain the SC-MAP include the following:

- Continue to have the Mayor and cabinet set direction for the organization and provide leadership in sustainability;
- Integrate sustainability where appropriate into Citi-Stat, performance management, capital improvement planning, strategic planning, budgeting, and staff training;
- Continue to have the Mayor's Office of Sustainability advance sustainability through policies, training, convening and facilitating the Green Team, sustainability planning, monitoring and management;
- All departments with lead roles in the SC-MAP take ownership over those actions, and approve roles and responsibilities (RACI model - Responsible, Accountable, Consulted, Informed) for implementing the actions;
- Develop guidance for identifying sustainability-related SMART goals for individual performance reviews across departments; and
- Evaluate the re-structuring of processes, procedures, and organizational structure to identify opportunities to conduct business more efficiently.



Addressing these organizational considerations will help optimize the outcomes of the SC-MAP's actions, while fostering collaboration and improving the capabilities of departments and individuals to continue improving the City's sustainability performance.

Implementation and Continuous Improvement

This SC-MAP is the first iteration of what will be a living document, subject to a continuous "Plan-Do-Check-Act" review and revision process as actions are implemented, progress is monitored, and new actions are developed. Employing a continuous improvement process will ensure the SC-MAP does not remain static or sit idle on a shelf, but rather continues to move the needle forward year after year.

Plan

The first component of the Plan-Do-Check-Act cycle is planning- embodied by the completion of this first version of the SC-MAP. The SC-MAP's goals and actions should be mapped to the departmental goals they support, as well as the Mayor's goals. Doing so will create synergies between goals, help establish momentum for implementing actions, and integrate sustainability into the City's standard operating procedures.

Do

The "Do" component entails implementing the SC-MAP's actions. Effective implementation requires accountability, whereby leading and supporting roles are assigned to each action and the necessary resources are allocated for implementation, from the cabinet level down to staff in individual departments.

Check

The "Check" component entails establishing a process to monitor progress toward the SC-MAP's desired outcomes. The Office of Sustainability will lead performance monitoring, but all departments will need to contribute. Performance monitoring includes tracking progress on each individual action, including performance indicators established for each action, such as resource and cost savings. The Office of Sustainability will report progress to Cabinet on a quarterly basis. The City will report progress to the public on an annual basis.

Act

The final "Act" component of the process entails taking corrective action for the SC-MAP based on the outcomes of performance monitoring. This may include revising or developing new actions, shifting roles and responsibilities, revisiting implementation time horizons, and other steps. It is anticipated that actions will be revisited on an annual basis, with goals being revisited over a longer time horizon.

Employee Education and Training

Another key component to implementation is employee education and training. Sustainability 101 training is now being offered to all employees, with approval from their supervisors. The Office of Sustainability also supports and/or provides green building training to project managers, facility managers, and other project team members. As sustainability training is further developed and institutionalized, a one-hour sustainability training could become part of the City's required trainings.

Providing employee training can help build a basic platform for engagement, break down silos among departments, and help staff work toward the goals and actions in the SC-MAP. Training can take many forms, from employee orientation materials and peer-to-peer learning to videos, in-person trainings, and annual sustainability events. The City's Green Team can be a conduit for training, employing a "train the trainer" approach whereby Team members can be the focal point for training efforts in their own departments – even establishing department-specific "green teams" for larger departments, such as the Airport's green team. Over time, sustainability should either be integrated into employee performance evaluations, and/or incentivized through employee recognition, office competitions, or other incentives.

Funding

One important component to SC-MAP implementation is funding for action implementation; for many actions, without funds the identified actions cannot be implemented. When exploring options for funding actions, the City can consider a number of different factors:

- Timing of actions relative to the City's budget cycle;
- Linkage of actions for financial planning – such as to the capital improvement plan;
- Identify projects that can utilize alternative financing approaches such as PACE financing, energy services contracts, revolving loan funds, and power purchase agreements, whereby limited or no upfront costs are required;
- Identify actions potentially ripe for grant dollars from federal, state, and foundation sources;
- Highlight actions that will save money and consider re-investing some cost savings in further action implementation;
- Identify "who pays" and "who saves" so that costs and savings can be apportioned; and
- Employ a life-cycle analysis approach, balancing short term pain points and long term savings and goals.
- Aligning projects with grant funding from federal, state, and foundation sources.

Communications and Reporting

Effective and timely communication will be critical in implementing the SC-MAP, including achieving its goals and completing its actions. With such a large and diverse municipal organization as Cleveland, effective communication will be necessary – both within the City and to its external stakeholders and community – to encourage participation and action, coordinate efforts, and report progress to City employees and leadership as well as the community.

During 2012, marketing research was conducted via multiple surveys by the Office of Sustainability with employees of the City of Cleveland. Generally, employees were aware of the City's sustainability initiative,

Sustainable Cleveland 2019, but were not familiar with about half of the projects currently underway within City departments, or the progress being made. A significant majority of employees know of their role in such activities as recycling paper office products and feel that sustainability is part of their daily life. Furthermore, they agree that a sustainable Cleveland is good for economic development, human health, and saves the City money and other resources.

The 8,500 City of Cleveland employees are the face and voice of the City thousands of times each day for residents, business commuters, institutions, visitors to the city, and the media. The public comes in contact with these employees in public spaces, City offices, by phone, electronic and printed communications, and in activities in their personal lives. The tone and tenor of the communication messages must therefore have a personal appeal. Employees who embrace sustainability initiatives in their work life are more likely to carry them into their personal lives and act as ambassadors to their communities. As evidenced in the staff survey responses, most employees already understand the value of good sustainability practices on the community. However, they also indicated that they want to be educated/trained and want lines of responsibility that are clearly defined and measured.

The Green Team members are a critical channel for all messages. It is important for them to engage the 20+ year employees in their respective department in the dissemination of information and implementation of new practices. These tenured employees had the highest response rate in understanding the importance of good sustainability practices and could be good influencers with their colleagues.

The communication plan will include messages, headlines, and timelines for information distribution using multiple channels currently available to the Office of Sustainability. Key steps to enhance communication include:

- Incorporate sustainability into new employee orientation to communicate from the outset the SC-MAP's goals and actions and how they relate to employee roles and responsibilities.
- Review job descriptions to help inform and include expectations for sustainable behavior and work habits.
- To foster cross-department collaboration, identify opportunities that impact multiple departments, and then communicate/coordinate those actions.
- Conduct communications and outreach to all employees – educate them about sustainability via webinars, workshops and seminars that are specifically designed for their department and role in the overall sustainability initiatives. Establish the www.SustainableCleveland.org website as the “one stop shop” for information about sustainability across Cleveland and Northeast Ohio. This site also directs people to Sustainable Cleveland Facebook and Twitter accounts. For information more specific to City leadership by example in sustainability, direct employees to www.city.cleveland.oh.us/sustainability.
- Use Green Team members and Department heads as the main conduit for distribution of information – these staff members are the ambassadors for sustainability to City staff.

APPENDIX A: GHG BASELINE INVENTORY METHODOLOGY

Methodology

This inventory was assembled through the collection and analysis of utility data, compiling of municipal and utility records, and discussions with City of Cleveland staff. Associated GHG emissions for all activities were calculated using an approach consistent with the International Council for Local Environmental Initiatives (ICLEI) - Local Governments for Sustainability's Local Government Operations Protocol as the main guiding document, with methodologies from The Climate Registry (TCR), the World Resources Institute (WRI), the Intergovernmental Panel on Climate Change (IPCC), and the U.S. Environmental Protection Agency (EPA) also referenced. Using ICLEI's guidance allows Cleveland to more accurately compare its GHG emissions to similar communities that have also followed this protocol.

Tools - Inventory Management System

Most of the calculations used to develop this inventory were carried out in an Information Management System (IMS), a Microsoft Excel-based spreadsheet that collects into one tool the original data, methodology applied, emission factors selected and a summary of GHG emission results. The IMS also provides charting, forecasting and benchmarking capabilities.

Greenhouse Gases

Table 1 summarizes the emissions factors that were applied in calculating the City's GHG emissions.

Table 1: GHG Emissions Factors

Emission Source	Emissions Factor	Source
Electricity – CPP	1,529 lbs CO ₂ e/MWh	U.S. EPA Emissions & Generation Resource Integrated Database (eGRID) 2009 data year.
Electricity – First Energy	1,471 lbs CO ₂ e/MWh	First Energy Emission Factor for CO ₂ , eGRID for CH ₄ and N ₂ O
Natural Gas	0.055 MT CO ₂ e / MCF	The Climate Registry General Reporting Protocol.
Chilled Water	0.065 MT CO ₂ e/MMBtu	
Steam	0.065 MT CO ₂ e/MMBtu	
Fleet Fuels	8.81 kg CO ₂ e / gal of gasoline 10.15 kg CO ₂ e / gal of diesel	The Climate Registry General Reporting Protocol, based on typical fleet vehicles
Jet Fuel	9.67 kg CO ₂ e / gal	The Climate Registry General Reporting Protocol

Solid Waste	0.48 MT CO ₂ e / wet ton waste	U.S. Environmental Protection Agency Solid Waste Management and Greenhouse Gases, Edition 3 (Landfill Gas Recovery and Flaring).
-------------	---	--

Baseline Inventory Findings

Table 2 summarizes the findings of the City's 2010 baseline inventory for energy, transportation, water, and waste activities. The table includes the annual quantity and cost for each source as well as the related GHG emissions for all applicable sources.

Table 2: City of Cleveland Municipal Operations 2010 Baseline Inventory

Source	Quantity	Cost	GHG Emissions (MTCO ₂ e)
Energy			
Electricity (kWh)	411,337,585	\$44,921,969	334,955
Natural Gas (MCF)	535,817	\$4,406,307	29,551
Steam (MLB)	71,685	\$1,590,962	5,578
Chilled Water (ton-hours)	2,027,605	\$1,099,356	1,586
Transportation			
Municipal Fleet Fuel (gallons)	2,566,076	\$7,665,100	24,285
Commuting	Not applicable	Not applicable	6,768
City Financed Travel (miles)	500,342	Not applicable	104
Water			
Water (MCF)*	68,900	\$1,990,397	Not applicable
Sewer (MCF)	67,406	\$2,752,425	Not applicable
Sludge (MCF)	29,397	\$1,569,652	Not applicable
WPC (MCF)	16,919	\$211,975	Not applicable
Waste			
Solid Waste (tons)	1,937	Not applicable	923
TOTALS	n/a	\$66,208,143	403,750

*Water consumption costs for municipal operations have been recorded here to represent the total costs the City of Cleveland would pay if all facilities paid for water use.

APPENDIX B: GLOSSARY OF TERMS/ACRONYMS

Term/Acronym	Definition
AEPS	Advanced Energy Portfolio Standard
AVL	Automatic Vehicle Locator
BAS	Building Automation System
BAU	Business-As-Usual.
BBC	Better Buildings Challenge
C2030D	Cleveland 2030 District
CAP	Climate Action Plan
CH ₄	Methane
CNG	Compressed Natural Gas
CO ₂	Carbon Dioxide
CPP	Cleveland Public Power
CSO	Combined Sewer Overflow
CWD	City of Cleveland Division of Water
WPC	City of Cleveland Water Pollution Control Department
DPM	City of Cleveland Division of Property Management
DPR	City of Cleveland Division of Parks and Recreation
DCM	Design, Construction & Maintenance
DPC	City of Cleveland Department of Port Control
DPU	City of Cleveland Department of Public Utilities
DPW	City of Cleveland Department of Public Works
ECMs	Energy Conservation Measures
EECBG	Energy Efficiency and Conservation Block Grant
EPA	U.S. Environmental Protection Agency
EPP	Environmentally Preferable Purchasing
EV	Electric Vehicles
GHG	Greenhouse Gas

Term/Acronym	Definition
GWP	Global Warming Potential
HFCs	Hydrofluorocarbons
kgal	Kilo-gallon
kWh	Kilowatt-hour
LED lights	Light-emitting diode
LEED	Leadership in Energy and Environmental Design
MCF	Unit of measure for water generally equal to 1,000 cubic feet
MTCO _{2e}	Metric Tons Carbon Dioxide equivalent
MWh	Megawatt-hour
N ₂ O	Nitrous Oxide
NEORS	Northeast Ohio Regional Sewer District
O&M	Operation and Maintenance
PFCs	Perfluorocarbons
RACI model	Responsible, Accountable, Consulted, Informed
RPS	Renewable Portfolio Standard
RTAs	Regional Transit Authority
SC-MAP	Sustainable Cleveland Municipal Action Plan
SF ₆	Sulfur Hexafluoride
SGP	Sustainable Green Printing
USGBC	U.S. Green Building Council
VMT	Vehicle Miles Traveled